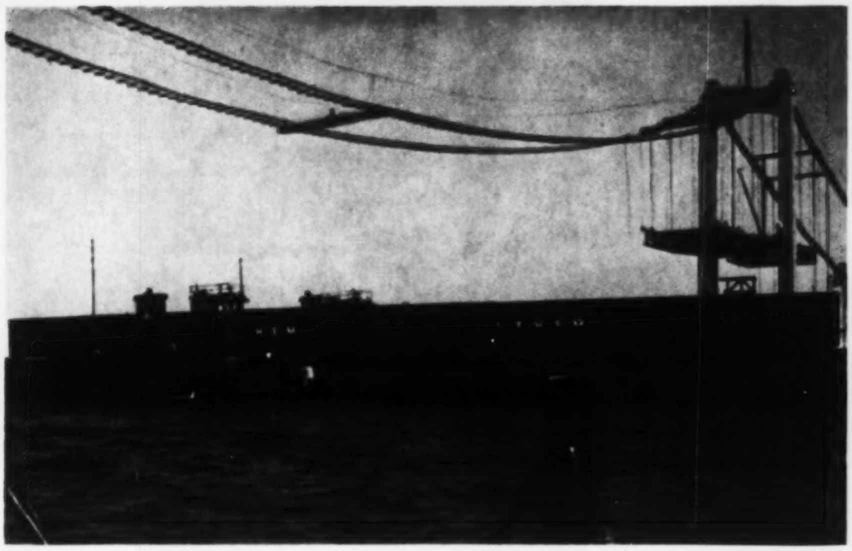
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • AUGUST 1960



STEEL ERECTION FOR THROGS NECK BRIDGE

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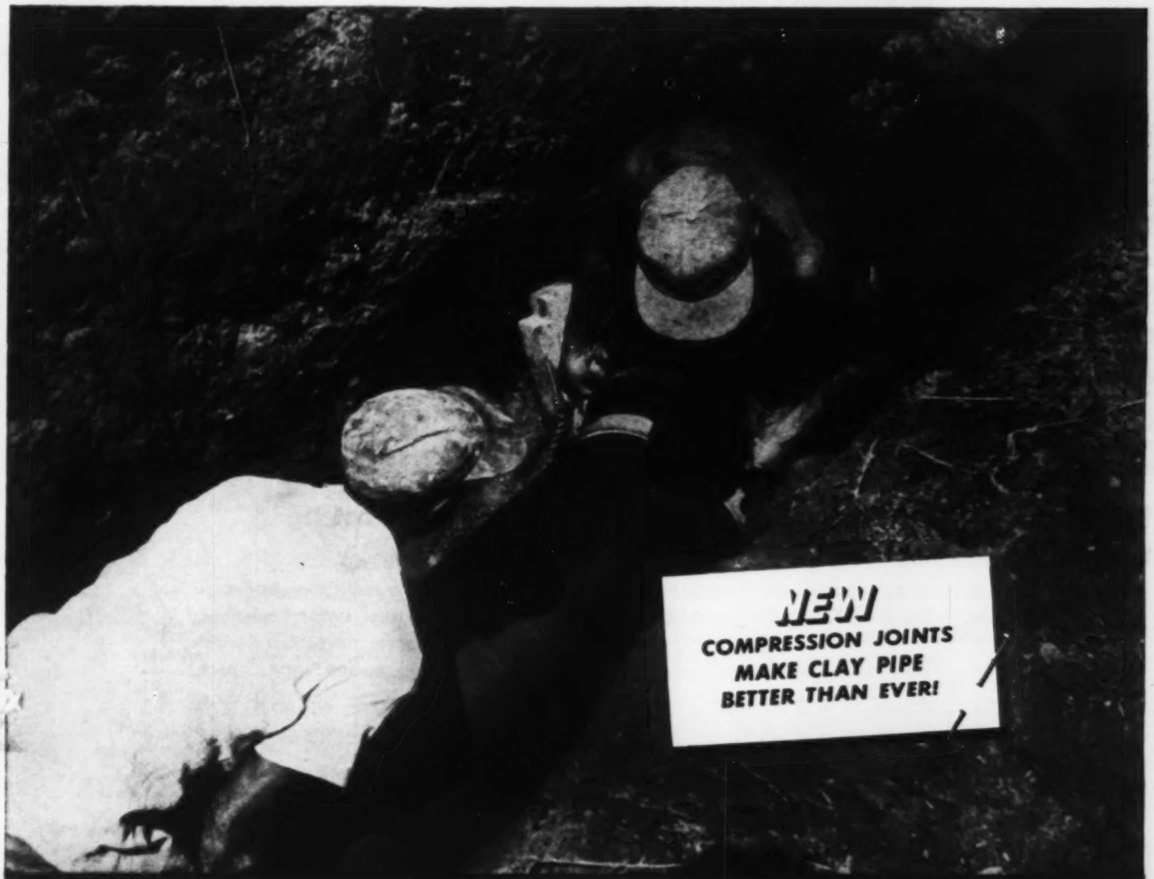

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CIVIL ENGINEERING

AUGUST 1960
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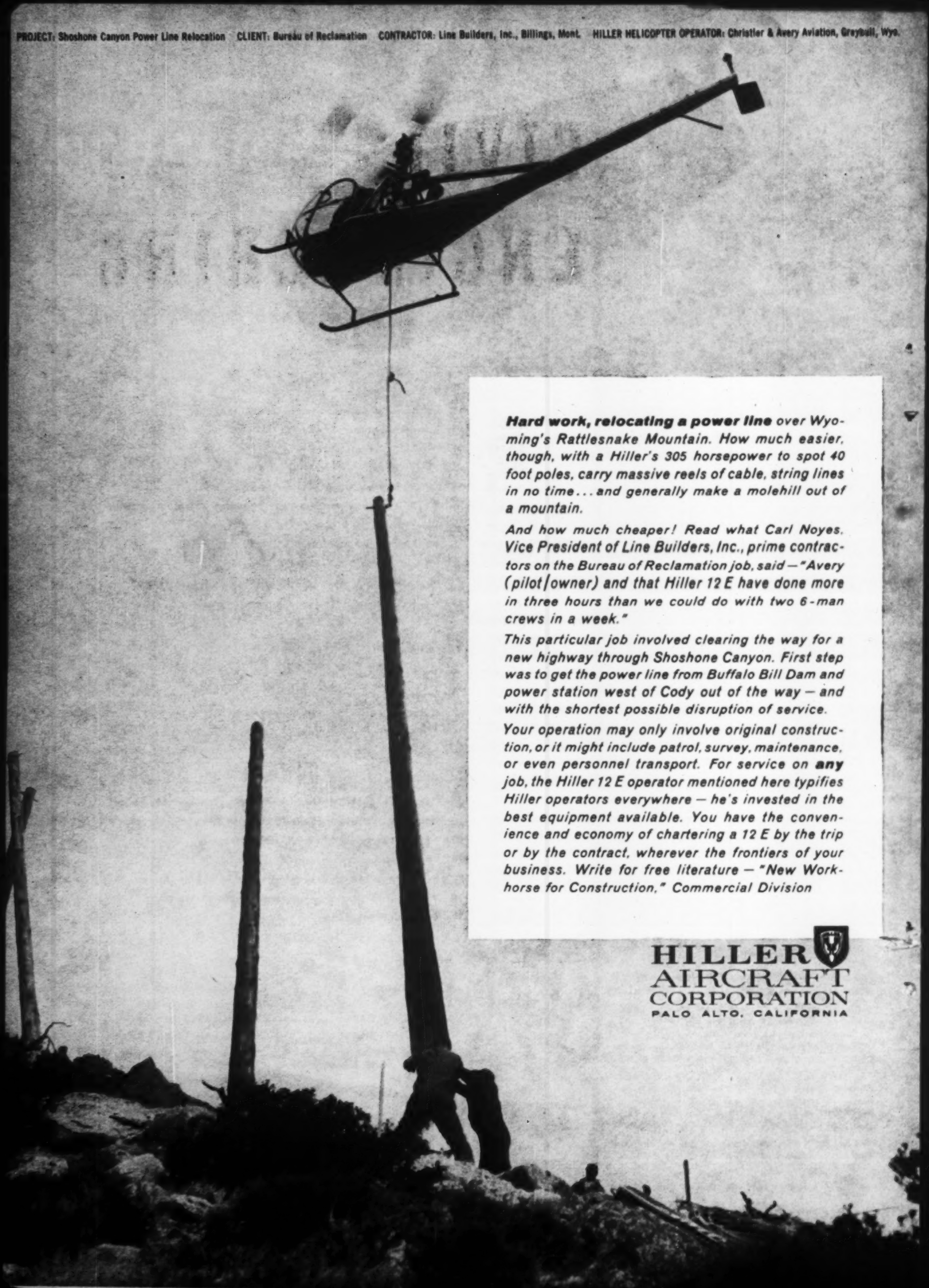
COVER: Throgs Neck Bridge. See page 119.

PROJECT: Shoshone Canyon Power Line Relocation CLIENT: Bureau of Reclamation CONTRACTOR: Line Builders, Inc., Billings, Mont. HILLER HELICOPTER OPERATOR: Christler & Avery Aviation, Greybull, Wyo.



Hard work, relocating a power line *over Wyoming's Rattlesnake Mountain. How much easier, though, with a Hiller's 305 horsepower to spot 40 foot poles, carry massive reels of cable, string lines in no time . . . and generally make a molehill out of a mountain.*

And how much cheaper! Read what Carl Noyes, Vice President of Line Builders, Inc., prime contractors on the Bureau of Reclamation job, said — "Avery (pilot/owner) and that Hiller 12 E have done more in three hours than we could do with two 6-man crews in a week."

This particular job involved clearing the way for a new highway through Shoshone Canyon. First step was to get the power line from Buffalo Bill Dam and power station west of Cody out of the way — and with the shortest possible disruption of service.

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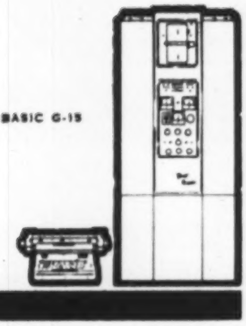

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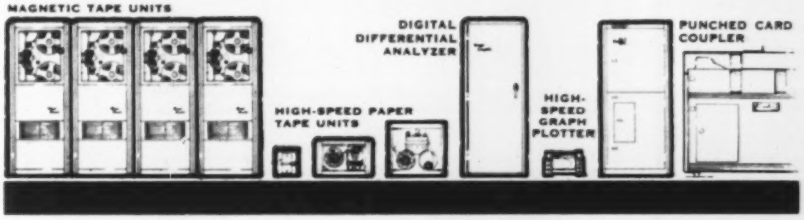
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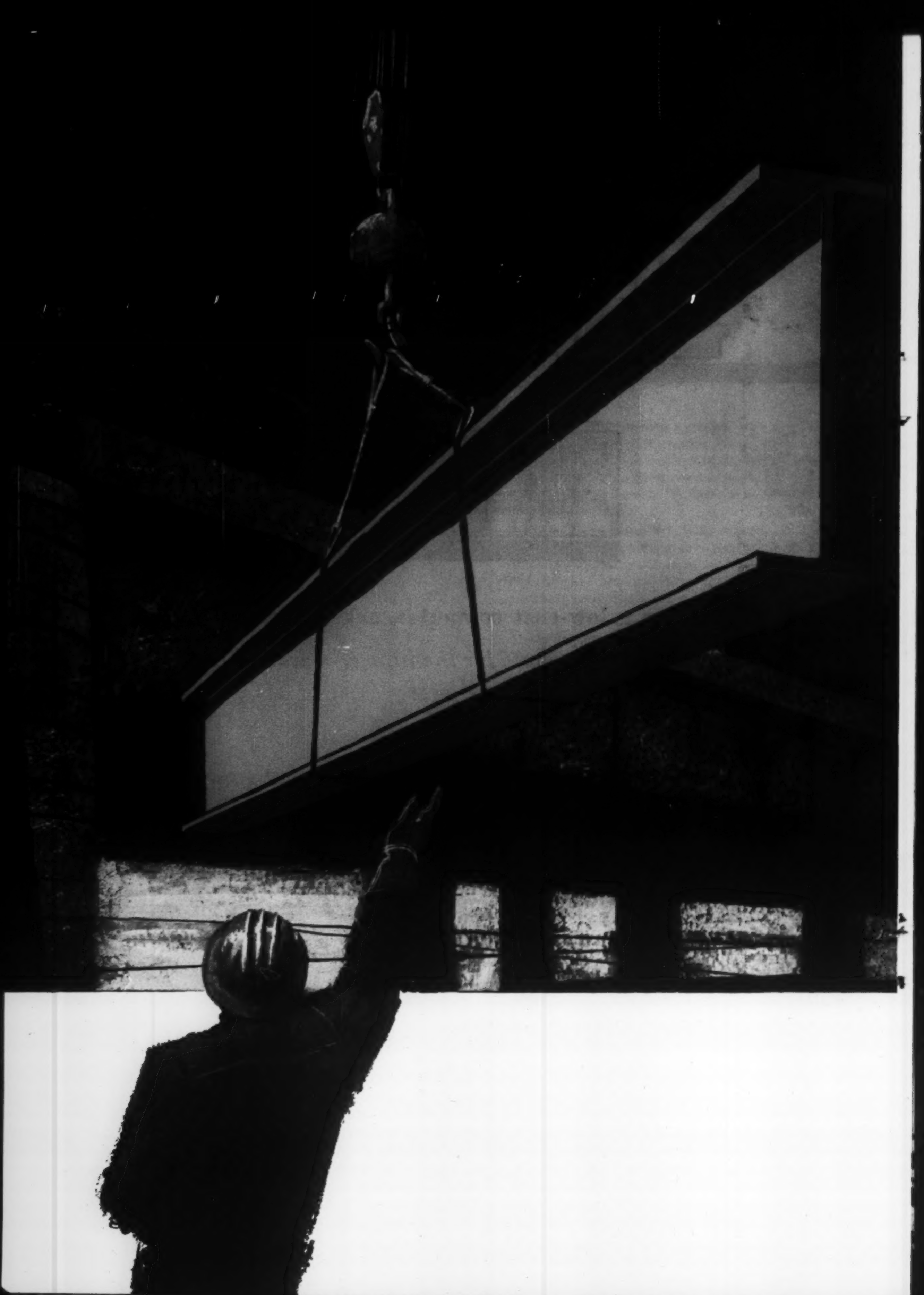

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United States Steel announces the availability of the newly adopted American Society for Testing Materials Specification ASTM A-36-60T Steel for Bridges, Buildings and General Construction. This new grade will be produced in wide flange beams, plates, standard structural shapes and bars.

Compared with ASTM A-7 structural steel, A-36 has a 9.1% higher yield point—permitting significant weight savings.

From a welding standpoint, A-36 compares favorably with ASTM A-373.

Chemical Requirements

		Shapes	Bars	Plates
A-7	C max.	....	....	....
	Mn	....	....	....
	Si	....	....	....

			¼" & Under	Over ¼" to 4" Incl.	¾" & Under	Over ¾" to 1½" Incl.	Over 1½" to 4" Incl.
A-36	C max.	.28	.28	.28	.28	.28	.28
	Mn	....	....	.60 /.90	....	.80 /1.10	.85 /1.20
	Si	....	....	....	....	....	.15 /.30

		Other Than Heavy W.F.	Heavy W.F. 10" to 36"	1" & Under	Over 1" to 4" Incl.	½" & Under	Over ½" to 1" Incl.	Over 1" to 2" Incl.	Over 2" to 4" Incl.
A-373	C max.	.28	.28	.28	.28	.26	.25	.26	.27
	Mn	....	.50 /.90	....	.50 /.90	....	.50 /.90	.50 /.90	.50 /.90
	Si	....	....	....	....	....	....	.15 /.30	.15 /.30

Mechanical Properties

	A-7	A-36	A-373
Yield Point, min psi	33,000	36,000	32,000
Tensile Strength	60 /75000	60 /80000	58 /75000
Elongation, 8" min %	21	20	21
Elongation, 2" min %	24	23	24

The higher yield point will allow an increased design stress of about 10% in both bridges and buildings and therefore will result in significant cost savings in fabricated and erected structures.
Write to United States Steel or any of the Divisions shown below if you would like more information about ASTM A-36. Better yet, call us.

USS is a registered trademark

United States Steel Corporation – Pittsburgh
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a giant needn't speak to be heard...

. . . he need only be a giant.

he need only do the things
that only a giant can do . . .
and he will be listened to.

we have a giant of our own.
his name is diesel.
he is an engine—
a supplier and creator of power.
his jobs are many and varied,
his demands are infrequent and few.

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he can work on almost any fuel.
on assignment
he can work almost anywhere at all.

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fishing fleets out of Portugal,
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in wartime he drove submarines
and landing craft.
today he helps atomic vessels
do their job.

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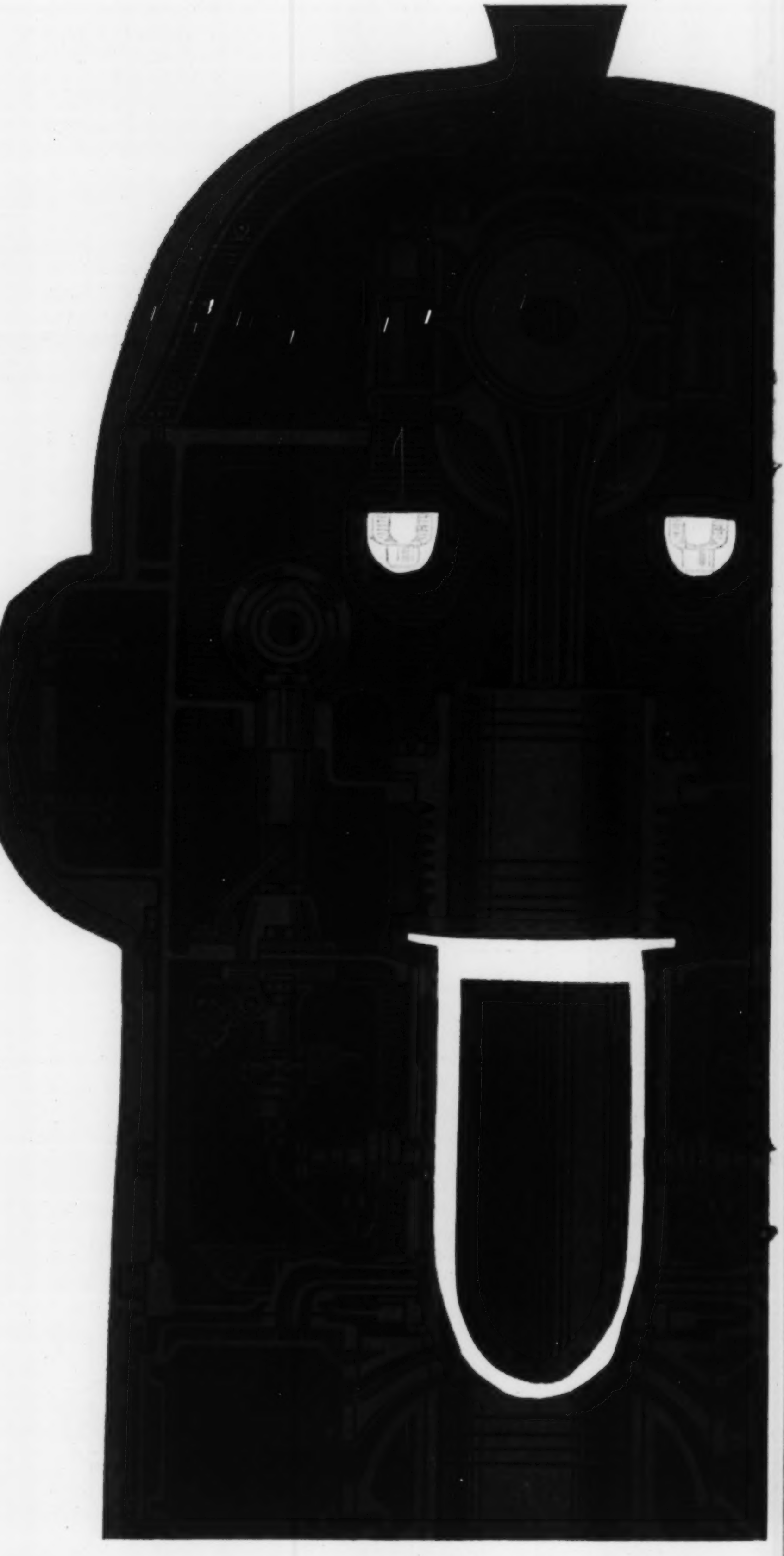
dredges in Manila Bay,
oil drills in Venezuela,
rigs in the Gulf of Mexico.
he pulls buses, trucks and tractors . . .
locomotives, rock-crushers
and bulldozers.

he generates . . .
light for cities
and power for plants,
electricity for homes
and more for hospitals.
he powers
missile stations in Wyoming,
radio stations in Sudan
and emergency stations in New York.

there is no country in the free world
where he is a stranger.

there is nothing he will not tackle
and little he cannot do.

his voice is in his accomplishments
and you hear it every day.



End cross-section of the
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TL 20

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Besides operating simplicity, a tractor loader has *firmly connected axles*—attached to frame with 2-inch diameter steel pins . . . no rolling and shifting under load. *Extra stability* lets operators get and deliver

move ahead with

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TL 20

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The "Big Three" tractor loaders range in size from the TL-14 with 5,300-lb carry capacity to the TL-20 (shown) with 9,000-lb carry. Each has a family of buckets—18 bucket loader combinations in all.

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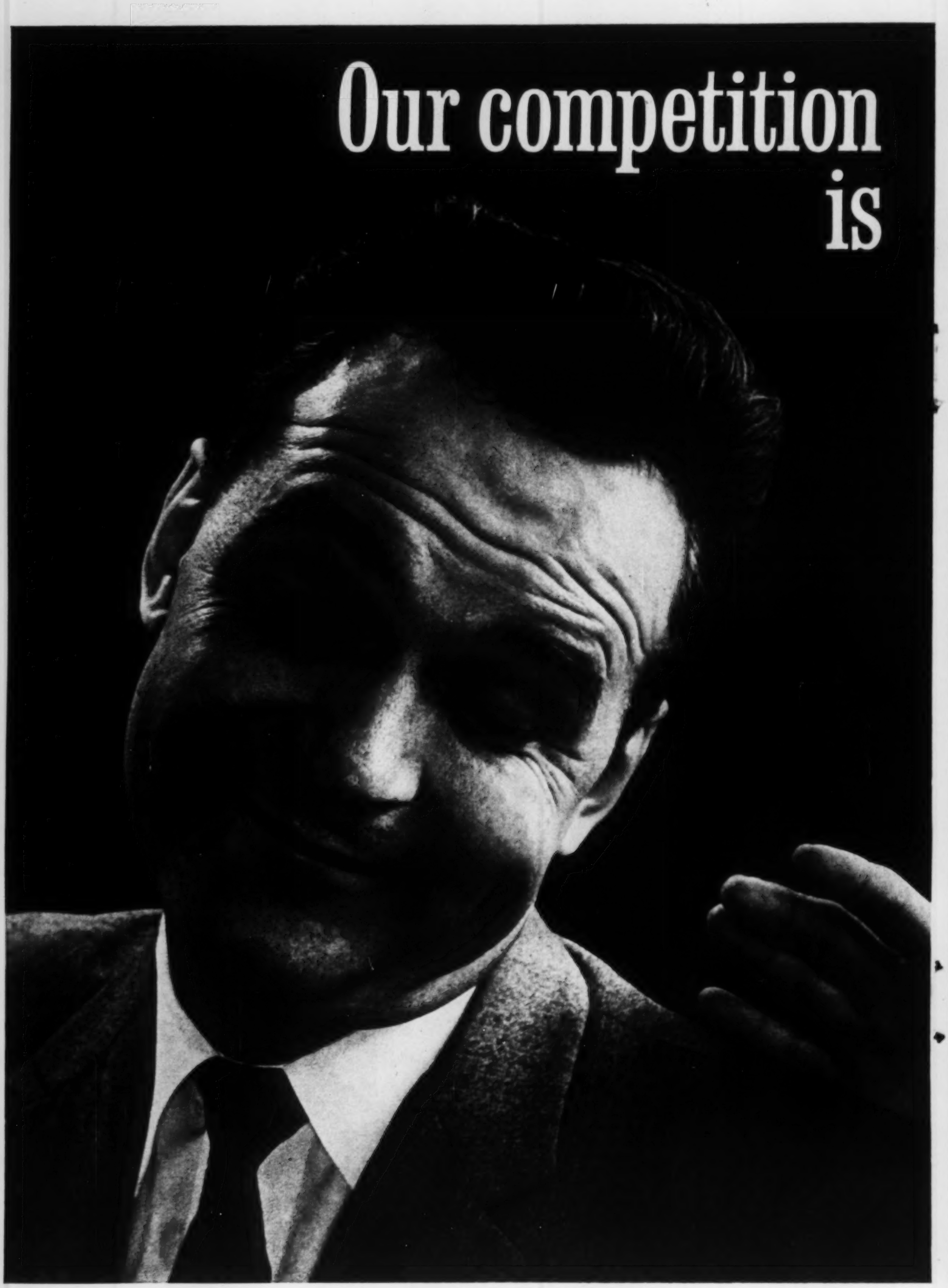
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Thank you, competition.

We're flattered.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

USS AmBridge I-Beam Lok gives four old bridges new life

Mulberry Street Bridge, Scranton, Pa. This old bridge carried two 23'6" roadways, 610' long, plus two 6' sidewalks. One roadway carried abandoned streetcar tracks; the other was paved with layers of asphalt, binder and concrete placed atop ⅜" steel buckle plates. All of this, including the old tracks, was removed and replaced with 31,000 sq. ft. of 4¼" I-Beam-Lok flooring—plus 10,500 sq. ft. of 2" Tee-Type Sidewalk Flooring. The roadways received a ¾" overfill. In addition to its light weight, ease of handling and speedy erection, I-Beam-Lok offered another advantage: it was specially shaped with a 4" crown to fit the existing beams. This eliminated framing problems and additional dead weight. The result, Scranton's old Mulberry Street Bridge is now far more useful and practically good as new.

Carbondale, Pa. Bridge This bridge has three approaches of varying lengths and grades on the bridge, plus a 125' main span. 4,900 sq. ft. of 4¼" I-Beam-Lok, with ¾" overfill, was used on the mainspan, and 18,725 sq. ft. of 5" open I-Beam-Lok on the approach spans. The old 24' roadway was made up of a layer of asphalt on 4" brick over a series of concrete arches between stringers varying from 6" to 21" in depth. It was estimated that, at most, the new I-Beam-Lok flooring weighed only 15% of the old floor—*reducing dead weight 85%*. During erection, there was no need to work from below the bridge, where railroad tracks and power lines would have made conventional construction more awkward than ever. The result: a lighter, stronger bridge that will serve the community better in the future.

Here you see examples of how USS AmBridge I-Beam Lok gives longer life to deteriorated bridges. Light I-Beam-Lok is ideal for increasing the live load of an old bridge. It's fast and easy to erect, and all work is done *top-side*. I-Beam-Lok gives you a strong, permanent steel bridge floor that requires very little maintenance.

There are two types of USS AmBridge bridge flooring: 5″ open I-Beam-Lok, and 4¼″ and 3″ concrete-filled I-Beam-Lok. The filled type is available in units 6′ wide and up to 49′ long that apply directly to stringers on spans from 6′ up to 8′ centers. The open type is also available for spans up to 4′ centers. For more details, contact one of our offices or write for our 32-page catalog.

USS, AmBridge and I-Beam-Lok are registered trademarks

Clearfield, Pa. Bridge This bridge was about fifty years old when its patched and repatched wooden floor simply wore out. A permanent new floor was needed, but it had to be light, since existing 12″ stringers had to be used. USS AmBridge 5″ open I-Beam-Lok, which weighs only 18.8 lbs. per sq. ft., proved to be the answer. The new steel floor is permanent and trouble-free, it has increased the strength of the bridge and reduced up-keep and snow-removal costs. In short, it might be said that the bridge over the West Branch of the Susquehanna in Clearfield, Pa. is now 50 years young.

Keokuk Municipal Bridge, Keokuk, Ia. The old timber floor of this bridge had been repeatedly resurfaced before it was refloored with 5″ TR-type open I-Beam-Lok. The bridge is 18′ wide by 3,152′ long, and required approximately 59,000 sq. ft. of the new flooring. Because I-Beam-Lok was lighter and stronger than the old floor, *it was possible to lift the 10-ton weight limit* which previously kept big trucks off the bridge. The weight saved in reflooring was roughly 3 or 4 times the weight of the I-Beam-Lok itself. The permanent, all-weather steel floor will save a considerable amount in upkeep and snow removal.

USS
**American Bridge
Division of
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The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

Optical Plummet solves problem on Niagara Power Project

"Sometimes a seemingly little thing can make a big job easy," says Frank Dickey, Project Engineer on the Niagara Power Project for Channel Constructors—a joint venture of Peter Kiewit Sons' Co., Morrison-Knudsen Co., Perini Corp., and Walsh Construction Co.

"We had an unusual problem here on excavations for the 500-foot-wide channel which will handle the water for the new Niagara hydroelectric plant. The conduits will pick up water from the Niagara River a couple of miles above the Falls and carry it underground through the city to an open channel, reservoir and 2,190,000-kilowatt power plant located several miles down the river.

"The channel had to be cut from dolomite. We decided to line drill the full 105-foot depth at one time, using 6-inch diameter holes on 5-foot centers. It was our intent to line drill the entire job, some 1600 holes, before any of the excavation was finished to grade. This made it necessary to devise a method of checking the holes for plumb from the surface so as to be sure that they did not deviate enough to get outside the tolerance allowed by the specifications.

"We thought of several ways to do this but none very practical, until one of the men mentioned having used a Gurley Optical Plummet Transit on another kind of job up in Canada. We decided to try the 'bobless transit' here.

Frank Dickey (r.) checks Gurley Optical Plummet Transit on Niagara Power Project job.

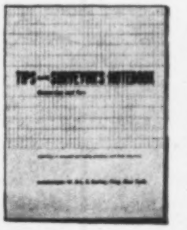
"We set up over the opening; then leveled the instrument with the North plate bubble over two opposing leveling screws. Then we sighted in the Optical Plummet and started moving the other two opposing leveling screws until we were able to pick up the light—by means of the 'OP'—from a dime store flashlight which had been lowered into the hole by a string.

"While moving the two opposite screws, we constantly checked the North plate vial to make sure that it remained level throughout the movement. After we picked up the light from down the hole, we moved the telescope until its bubble was in the center. When this was established, we read the vertical circle—this giving us the angle at which the hole had been drilled.

"This proved to be accurate and a fast system for checking the holes and undoubtedly gave us a better job than we could have otherwise obtained.

"This use of the 'OP' is a special case," Mr. Dickey added. "But I'll bet there will be many other jobs that the 'OP' can lick. For years I cussed the plumb bob, especially when the wind was blowing... always wished someone would do something about it."

You, too, can do something about the plumb bob problem. Gurley *built-in* optical plummets eliminate outmoded bobs... save set-up time... improve accuracy. *Bulletin OP-100 gives complete details on two models available.*



***"Tips from The Surveyor's Notebook"**: We have collected the most helpful, most discussed pages from Series One and Two of "The Surveyor's Notebook" in one 20-page book. These valuable field suggestions will help you use your own instruments with greater success. Write for your free copy.*

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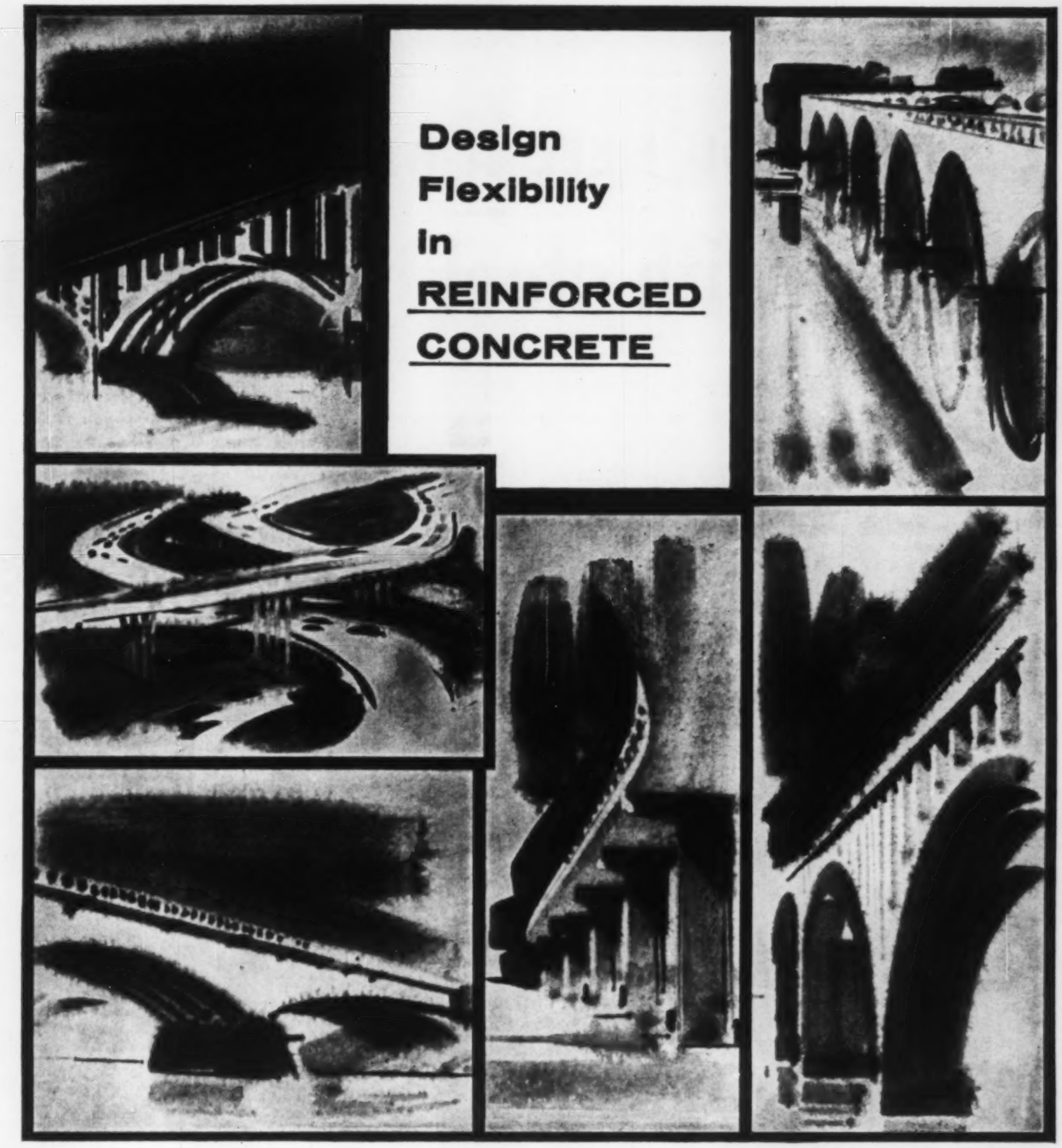

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Your structural steel fabricator can get you all the structural steel shapes you need. And fabricate them just the way you need them. Let him show you what he can do. You'll be glad you did.

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Steel

for Strength
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Surfaces like these protected against rust with

ALL THREE COATS

with

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1-4-3 (one-for-three)

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Conforms to ASTM
Specification D-1648

Permox 1-4-3 is an unusually effective anti-corrosive paint pigment. Using it as the basis for all three paint coats—primer, intermediate and finish—surfaces such as bridges, storage tanks and farm implements, exposed to severe weather conditions, are provided with *cumulative* protection against rust.

Paints made with Permox 1-4-3 are easily tinted and have excellent chalk resistance. These qualities make possible the production of durable, rust inhibitive maintenance paints and enamels in an almost unlimited assortment of contrasting colors and with superior tint retention.

Suggested formulations are available for a wide variety of these anti-corrosive and decorative paints designed for specific needs. We welcome inquiries and are prompt to respond.

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JOB REPORT: ***NELSON Stud Shear Connectors in Composite Construction***

COMPOSITE *STEEL-CONCRETE* CONSTRUCTION*

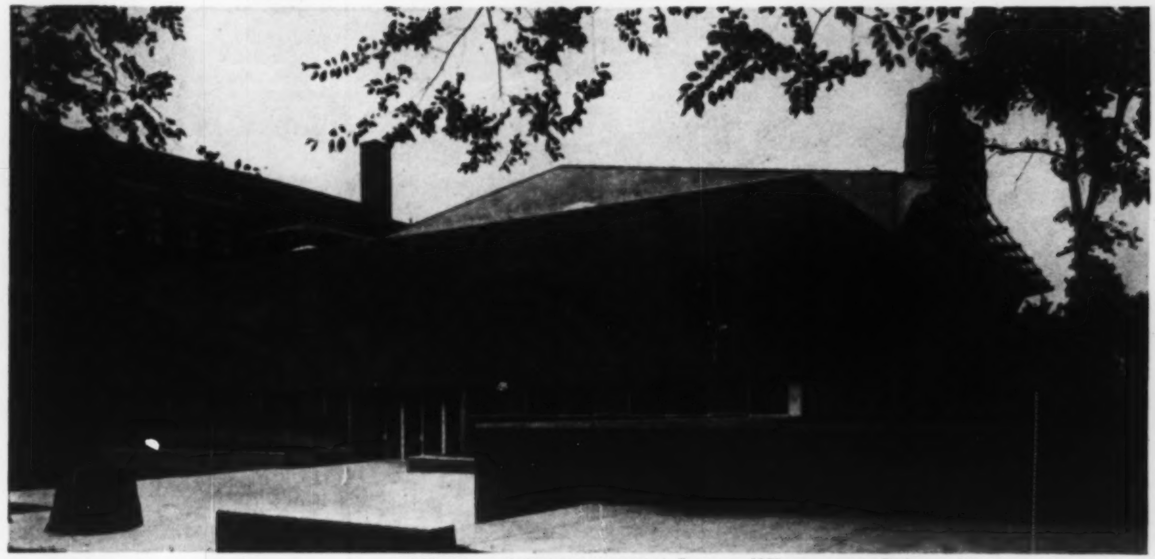
...in new Syracuse Parish Center

"On this project, long span floor construction was necessary to conform with column-free room areas. Composite Construction was used because it effected reductions in steel tonnage, depth of construction and resulting building costs." So says Thomas M. Farmer, Consulting Structural Engineer on the Most Holy Rosary Parish Center, Syracuse, New York.

Although, Composite Construction for buildings is relatively new (it has been employed in bridge construction for over three decades), more and more engineers are using it to gain these economies and advantages over non-composite construction ... *shallower beams,* to meet equal load requirements · *reduced over-all cubage,* economies in materials · *longer spans,* greater load-carrying capacity per-pound-of-steel · *wider spacings of columns,* more unobstructed floor space.

**A steel and concrete composite beam is made up of three essential elements: A steel beam, a reinforced concrete slab, and shear connectors. Horizontal shear is transferred to the beam through the shear devices which join the slab to the beam in such a way as to cause the concrete and steel elements to act as a unit.*

Call in your local Nelson field representative, or write for "The Case for Composite Construction", Nelson Stud Welding Division, GREGORY INDUSTRIES, INC., Dept. 10, Lorain, Ohio.



MOST HOLY ROSARY PARISH CENTER, Syracuse, N.Y.—**Architects:** Pederson, Hueber and Hares, Architects – Glavin, Landscape Architect • **Consulting Structural Engineer:** Thomas M. Farmer • **General Contractor:** Gallagher and Vault, Inc. • **Structural Steel Fabricator:** Empire Structural Steel Fabricators, Inc. • **Steel Erector:** Bornhurst, Inc.

NELSON Stud Shear Connectors *are approved by the AASHO for bridge construction.*

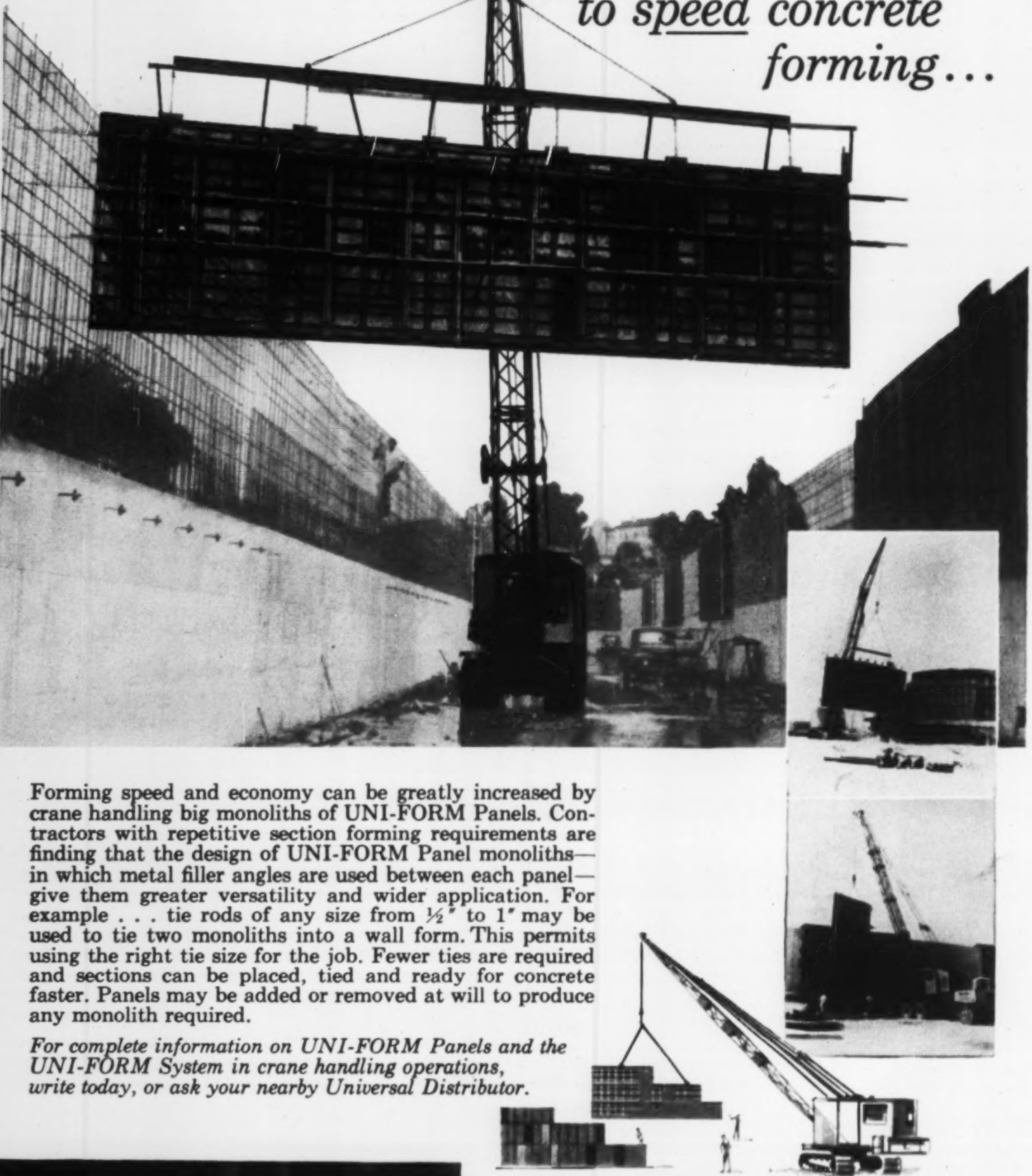
NELSON STUD WELDING

DIVISION OF GREGORY INDUSTRIES, INC.

Manufacturers of... NELSON STUD WELDING PRODUCTS • NELSON BULLDOG CONCRETE FASTENING PRODUCTS • NELSON POWDER-ACTUATED FASTENING TOOLS

AIRBORNE UNI-FORM PANELS

smart way
to speed concrete
forming...



Forming speed and economy can be greatly increased by crane handling big monoliths of UNI-FORM Panels. Contractors with repetitive section forming requirements are finding that the design of UNI-FORM Panel monoliths—in which metal filler angles are used between each panel—give them greater versatility and wider application. For example . . . tie rods of any size from ½" to 1" may be used to tie two monoliths into a wall form. This permits using the right tie size for the job. Fewer ties are required and sections can be placed, tied and ready for concrete faster. Panels may be added or removed at will to produce any monolith required.

For complete information on UNI-FORM Panels and the UNI-FORM System in crane handling operations, write today, or ask your nearby Universal Distributor.

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To be perfectly truthful, our product (LARGE-DIAMETER STEEL WATER PIPE) is really quite good

We make electric fusion-weld steel pipe in sizes from 18 in. ID to the largest you could possibly use. We've made it (and cities like yours have *used* it) since before the turn of the century. After sixty-plus years of experience, we are convinced that steel is the best material for moving large volumes of water.

Is steel pipe as good as we claim? Well, let's consider Six Good Reasons For Using Steel Pipe.

1. Internal Strength. No other material matches steel's ability to withstand high pressures, water hammer, shock loadings, surge. This is *proven* strength—every single length of large-diameter steel pipe is hydrostatically tested in the shop to AWWA standards.

2. Beam Strength. The structural strength of tubular steel is unquestioned. Some diameters can span as much as 120 ft without supports. This quality enables steel pipe to span washouts, or to be installed above ground with fewer supports than other materials.

3. Elasticity. Steel "gives" under loads that would crack rigid materials. It can withstand the pounding of heavy traffic, the shock of nearby explosions, even earthquakes.

4. Leakproof Joints. A welded line is absolutely bottle-tight. And if coupled or gasketed joints are used, the allowable leakage runs only a fraction of what's needed for concrete pipe.

5. Corrosion-Resistant. Modern, coal-tar-enamel lining and coating materials give unexcelled protection against corrosion and incrustation. You just can't get higher flow capacity than in a tar-enameled steel main.

6. 40-Ft Lengths. The longer lengths mean fewer joints—only 132 a mile. Steel pipe is easy to handle, too, weighing only about one-fifth as much a foot as concrete pipe.

These are the facts. And they're all good reasons why you should consider large-diameter steel pipe for your next water main. We'd be happy to discuss the matter with you. Just contact the Bethlehem sales office nearest you.

Steel For strength
. . . economy
. . . versatility

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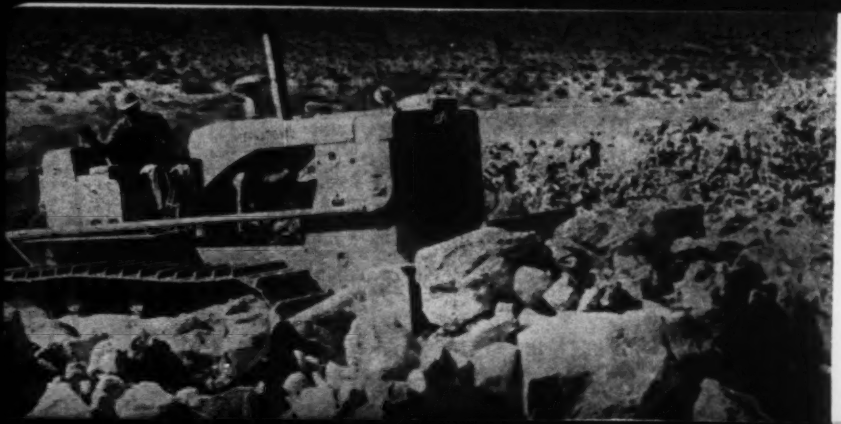

Even moving a blade-full of shot-rock around the curve, there's no hesitation, no sluing to spill the load. The TD-25's operator has separate speed control of each track to get full-capacity performance, full time. And only the new TD-25 has the power plus of the direct-start, turbocharged DT-817 International engine—that delivers 230 high-torque hp!

HOW POWER-STEERED, POWER-SHIFTED . . . TD-25 takes

—on California mining operation

Even before all the blast dust has settled, this International TD-25 is slamming tons of shot-rock from the benches, so trucks can resume hauling to the processing plant. Then, at this gypsum mine in California, the "25" takes over the "shovel-feeding" chore—dozing full blades of rock upgrade, downgrade, and 'round the curves, to help keep the big dippers swinging full. And in between times, the "25" takes over its third tough project: benching new haul road around mountain slopes!

Three slam-bang rock operations to handle—it's a made-to-order situation for the Planet Power-steered TD-25!

"Dead-track drag" eliminated! You don't brake a track and "half-kill" your pull-power to turn, as you do with king-sized clutch-steered crawlers. With Planet Power-steering you simply change the speed of one TD-25 track—on-the-go, and with 2-finger ease! Around comes the fully-loaded TD-25—with "live" power on both tracks and both tracks pulling. Load-limiting "dead-track drag" is eliminated!

And combined, on-the-go Hi-Lo power-shifting lets you match power to load, instantly—forward or reverse. Just shift one track to high range—the other to low—to do slope-hugging, full-bite benching, or to operate straight ahead with off-center loads!

The "25" is platformed on new 7-roller tracks with double-box-beam frames. The design provides super undercarriage strength for slam-bang conditions—strength to match the full effort of the direct-start, high-torque DT-817 International Diesel engine.

Power-steer and power-shift the TD-25 with king-sized loads. Measure the bonus capacity you get with exclusive Planet Power-steering and Hi-Lo power-shifting. See how this control combination enables you to outearn other big rigs up to 50%. Then measure what it means to get this double-barreled advantage *only* in the TD-25—and as standard equipment *to boot!* Let your International Construction Equipment Distributor demonstrate.

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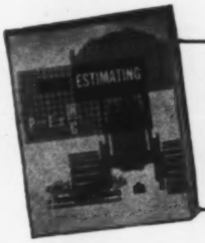
POWER PACKAGE

International® Construction Equipment

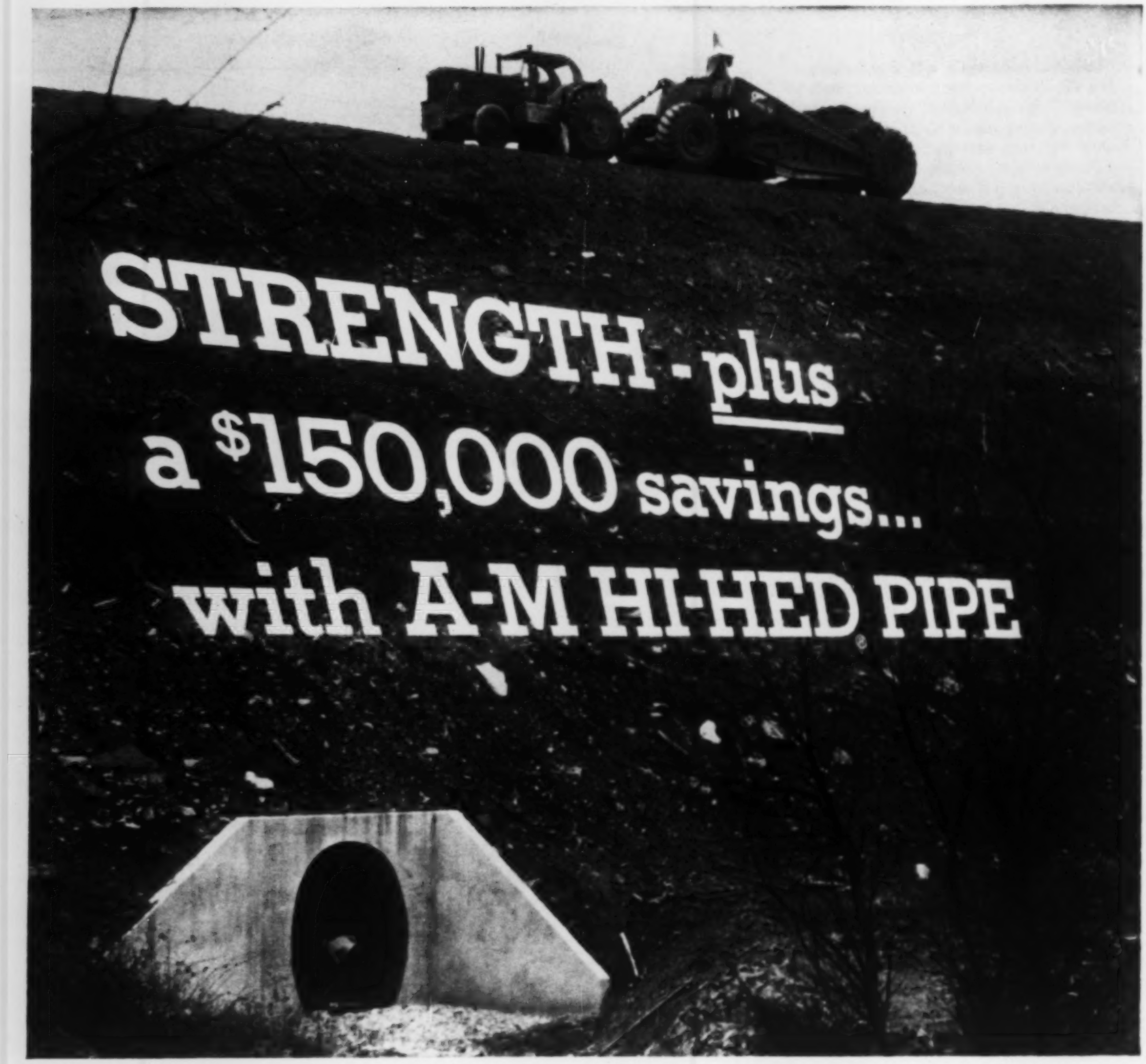
"Boulder-dozing" after blasting— The TD-25 does some "blasting" itself to move "big-as-a-house" hunks of rock aside. Heavy-duty TD-25 Dura-Rollers defy the rock-dozing "grind"—with the industry's thickest shells to prevent flexing—positive grit exclusion—and 1,000-hr.-interval lube capacity!



Here's your 76-page cost and production estimating book—newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, *anywhere!* See your International Construction Equipment Distributor!

over three slam-bang rock jobs

INTERNATIONAL
25



STRENGTH was the first requirement for a 4,000 foot drainage structure under the new east-west runway at Greater Pittsburgh Airport. Precast concrete Hi-Hed pipe provided this essential strength (50% stronger on the average than equivalent size round pipe), plus a big bonus in the form of an estimated saving of $150,000—approximately 18% savings over competitive material.

Versatile A-M Hi-Hed Pipe is designed for minimum vertical load and maximum lateral support . . . saves trench width in congested areas . . . is readily available in sizes up to 144" round pipe equivalent from plants strategically located throughout the nation. Write today for illustrated Hi-Hed brochure.

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Oncle Bull but Tyton lays so easy
he ain't even stirred."*

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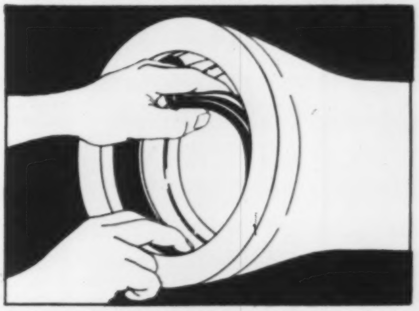
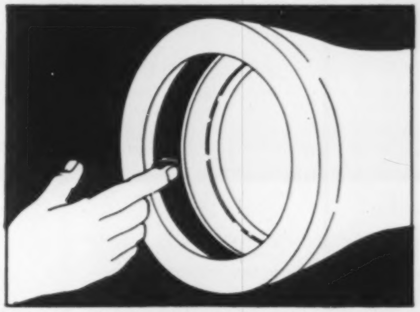
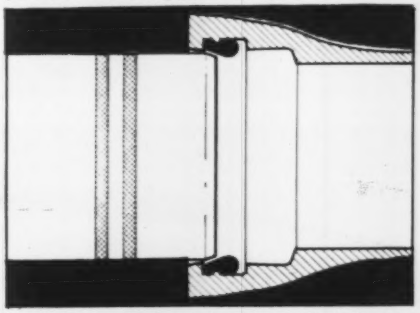


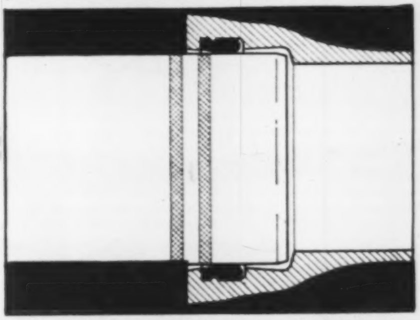
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?

NEWS OF MEMBERS

John B. Herbich has been promoted to the rank of associate professor in the department of civil engineering at the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa. Since 1957 chairman of the hydraulics division in charge of research projects in the hydraulics laboratory, Professor Herbich has also conducted research at the University of Delft, Holland; City and Guilds College of Science and Technology, London, England; and the University of Minnesota.

Brother Amandus Leo, president of the Association of Engineering Colleges of New York State and dean of the School of Engineering at Manhattan College, N. Y., last month visited engineering schools in Lebanon and Israel as a representative of the New York State Education Department. His itinerary included the American University of Beirut, Lebanon, and the Israel Institute of Technology, Haifa. Brother Leo also conducted an engineering survey of structural aspects of the Frederick Mann Auditorium in Tel Aviv, Israel—especially its much admired acoustical and structural advantages—for the design engineers engaged in plans for the new Metropolitan Opera House in New York.

Charles H. Knight, Jr., new district engineer of the Portland Cement Association for the states of Washington, Oregon and northern Idaho, has been with the association for four years serving as general field engineer and as Los Angeles district conservation engineer. His office is in Seattle.

Kenneth H. Yarnell has joined the offices of the Oil City (Pa.) Engineering Department. For the past year, Mr. Yarnell has been employed by the Pantech Engineer Company of Oil City.

Earl I. Brown II leaves his post this month as assistant dean of the Alabama Polytechnic Institute Engineering School at Auburn, Ala., to become J. A. Jones Professor of Civil Engineering and chairman of Duke University's civil engineering department. He succeeds **Robert S. Rowe,** who is leaving to become dean of the engineering school at Vanderbilt University, Nashville, Tenn.

William Whipple, Brigadier General, Corps of Engineers, and Southwestern Division engineer for the Corps at Dallas, retired from active duty on July 8 upon completion of 30 years' service. At a dinner honoring him in Little Rock, Ark., he received the Legion of Merit, with two oak leaf clusters, for "exceptionally meritorious service"—based upon "decisive direction" of a $290,000,000 civil works and military construction program in the Southwest. General Whipple's first civilian job will be as chief engineer for the 1964 New York World's Fair.

Robert L. Schiffman, of the department of civil engineering at Rensselaer Polytechnic Institute, has been promoted from assistant to associate professor. He received his doctorate from Rensselaer on June 10 and will spend the summer studying at Delft Technological University in Holland. Mr. Schiffman was recent co-winner with **Charles R. Wilson,** of an ASTM award for a paper on "The Mechanical Behavior of Chemically Treated Soils."

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CONCRETE CONTRACTOR: STRESDEK, INC.

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NEW YORK
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(Albany, N. Y.)
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MEMBER PRESTRESSED CONCRETE INSTITUTE

D. E. Dreier, formerly vice president and chief engineer, of Walker Process Equipment, Inc., Aurora, Ill., has been appointed vice president and chief of engineering and research. Prior to 1945 when he helped organize Walker Process Equipment, Inc., he served as senior sanitary engineer with the Illinois Department of Public Health.

Ronald C. Hirschfeld, a 1958 Ph.D. graduate of Harvard University, and since then an instructor there, was recently named assistant professor on the Harvard faculty of arts and sciences. Dr. Hirschfeld was a recent participant in a research conference at the University of Colorado.

Abbott L. Penniman, Jr., retired recently as vice president of electric operation for the Baltimore Gas and Electric Company at Westminster, Md. Mr. Penniman has been associated with the utility company for nearly half a century.

Howard Dillon, starting with the opening of the fall term in September, will be on the civil engineering staff at Indiana Technical College. Mr. Dillon, whose graduate studies have been in structures, is currently completing work toward his master's degree at the University of Louisville, where he has served as instructor for the past two academic years.

Burton J. Bell, chief of the Corps of Engineers' Technical Information Branch, Atlanta, Ga., and **Dwight F. Johns,** Brigadier General, and chief of the Engineer Services State Office of Civil Defense, Sacramento, Calif., have been named by the Society of American Military Engineers as Southeast and West regional vice presidents.

Gen. Leif J. Sverdrup (left), president of Sverdrup & Parcel, Inc., St. Louis engineering firm, received the honorary degree of doctor of science from Chancellor Ethan A. H. Shepley of Washington University at commencement exercises on June 6. General Sverdrup became a senior partner in Sverdrup & Parcel in 1928.

(Continued on page 32)

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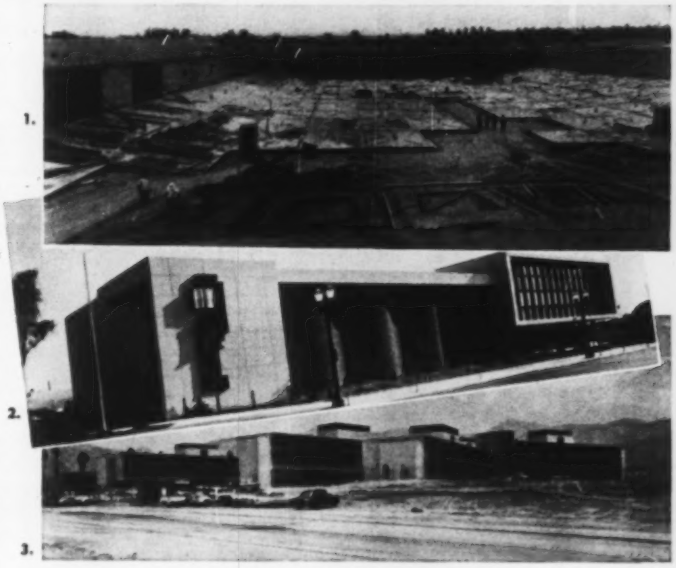
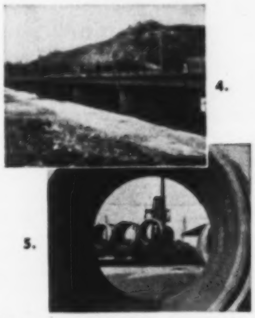


1. *Ontario Reservoir, Ontario, California.*
2. *Glendale County Courts Building, Glendale, California.*
3. *University of California at Riverside, Residence Hall Units 1, 2 and 3, Riverside, California.*



4. *Mission Boulevard Pre-Stressed California State Highway Bridge, Riverside, California.*
5. *Concrete Pipe Manufactured by F. Hurlbut Co., Green Bay, Wisconsin.*

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Maraconcrete is being used in the construction of reservoirs, bridges, runways and buildings . . . in the manufacture of reinforced concrete beams and pre-cast structures, in pipe and drain tile.

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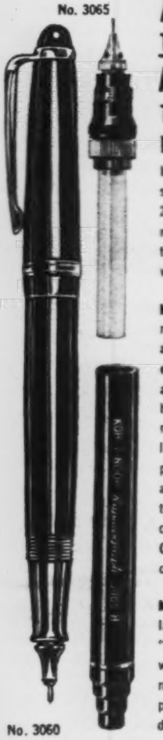

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TECHNICAL
FOUNTAIN PENS

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MODEL NO. 3060: The regular Koh-I-Noor Rapidograph "Technical" Fountain Pen with self-contained automatic filling system, and pocket clip is a standard drafting room tool.

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Non-slip, turn-proof clutch takes full range of Koh-I-Noor lead.

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PENCIL COMPANY, INCORPORATED
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News of Members

(Continued from page 31)

C. A. Budnik, formerly assistant manager of industrial construction for Kaiser Engineers at Oakland, Calif., has been appointed general manager of the Titan Installation and Activation Division of the American Machine and Foundry Company's Government Products Group, Greenwich, Conn. Prior to his Kaiser position, Mr. Budnik was consultant to the Corps of Engineers on construction problems related to military air base installations in the Caribbean area.

Fred A. Camp, civil engineer and associate in the Water Design Division of the Los Angeles Department of Water and Power, is in Ljubljana, a resort, rail and industrial center of Yugoslavia, this summer. During his stay he will visit with professors at the University there and with the manager of Elektroprojekt, who is arranging a meeting of engineers in the area to hear an address by Mr. Camp.

William E. Harrison, after two years as assistant manager of the Washington, D. C., office of Armco Drainage & Metal Products, Inc., has become manager of the office. During the 15 years he has been with the firm he has also served as division engineer and Indiana state sales manager.

Arthur P. Miller, whose assignments have covered the full range of public health engineering activities during almost 40 years with the U.S. Public Health Service, retired recently as program officer in the office of the chief of the Service's Bureau of State Services, Washington, D. C. His career has included investigations of water supplies in Tennessee in connection with outbreaks of typhoid fever as well as work on the design, construction, and operation of sanitary works in Yellowstone, Glacier, Rocky Mountain, and Yosemite National Parks.

Harry T. Immerman, of Spencer, White & Prentis, Inc., was honored by the building and contracting industry at its annual dinner for the United Jewish Appeal on June 21 in New York City. During the evening **Peter J. Reidy,** New York City Building Commissioner, was awarded a special "industry citation." Prior to his appointment to the Buildings Department in 1958 Mr. Reidy was for many years president of Purdy & Henderson.

Albert P. Boysen, a veteran of nearly 48 years service with the American Bridge Division of the United States Steel Corporation, retired recently as district engineer in the division's Chicago office, a post he has held for the past 14 years. Between 1935 and 1946, he was in charge of design for all U.S. Steel buildings in the Western area, including the Columbia-Geneva steel plant at Geneva, Utah.

George J. Viertel, consulting engineer of Newport News, Va., has been elected chairman of the functional section of Consulting Engineers in Private Practice of the Virginia Society of Professional Engineers. Mr. Viertel has served as director of the Virginia Society of Professional Engineers for several terms. Before entering private practice in 1950, he was employed by the National Advisory Council for Aeronautics as a project engineer.

Meyer S. Bogost, for the past eight years special assistant for sanitary engineering with the District Public Works Office of the 14th Naval District, Pearl Harbor, Hawaii, has severed this connection to join the firm of L. Frederick Pack Associates of Hawaii, Ltd., as director of the company and sanitary engineer in the Design Division.

Ray D. Spencer, formerly vice president of Koebig and Koebig, of Los Angeles, Calif., has become president of the firm. Mr. Spencer succeeds Adolf Koebig, Jr., who passed away in April.

Edward K. Davison, since 1955 president of J. K. Davison & Brothers, of Pittsburgh, Pa., was recently elected president of the National Sand and Gravel Association. Mr. Davison has been active in industrial affairs and has been a member of the board of directors of the N.S.G.A. since 1951.

Francis S. Friel, Philadelphia civil engineering consultant and former Society president, and **George F. Ferris,** newly elected chairman of the board of Raymond International, Inc., received honorary degrees of Doctor of Engineering Science at the recent Lafayette College commencement exercises for their creative engineering efforts and contributions to the profession. Mr. Friel was singled out for his participation in international dam, power and soil mechanics projects, while Mr. Ferris was honored for his work as a top design engineer.

Harold Bateson recently was admitted as a partner into the consulting engineering firm of Charles A. Maguire & Associates of Providence, R. I., and Boston, Mass. After several years as project engineer with the firm, Mr. Bateson was named an associate last year.

G. Brooks Earnest, president of Fenn College, was one of three alumni receiving special honors at the recent 75th anniversary reunion banquet of the Case Institute of Technology Alumni Association. President Earnest is a former Society Director and Vice President.

E. B. Downing, Colonel, Corps of Engineers, U. S. Army, is being transferred from the Office of the Chief of Engineers, Washington, D. C., where he has been engineer comptroller since 1957 to a new assignment as secretary of the Mississippi River Commission and deputy division engineer of the Lower Mississippi Valley Division at Vicksburg. Colonel Downing was commissioned in the Corps in 1933 following graduation from West Point.

George M. Foster, who is presently executive director of the Indiana State Highway Department, has been named executive director of the Better Highways Information Foundation, Washington, D. C. Mr. Foster brings to the position of executive director a record of nearly 40 years of broad experience in highway matters, including six years as chief deputy commissioner of the Michigan State Highway Department and three years as head of the Indiana State Highway Department.

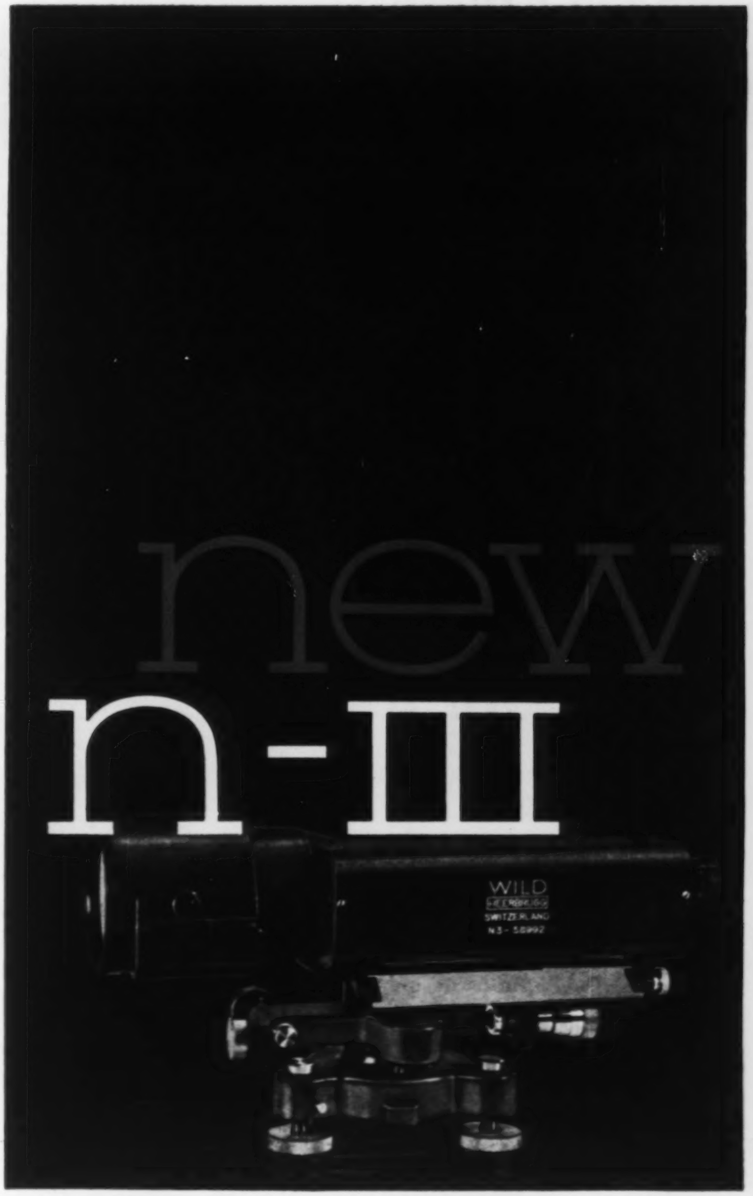
C. Leonard Hulsbos, for 14 years a member of the faculty at Iowa State College—for the past three years as professor of civil engineering—has been named research professor of civil engineering at Lehigh University, Bethlehem, Pa. Another recent appointee to the Lehigh civil engineering staff is **John M. Hanson,** structural engineer with the Denver (Colo.) firm of Phillips Carter-Osborn, Inc., who will be research instructor in civil engineering.

Romeo R. Martel, a pioneer in the design of earthquake-resistant structures and nationally known engineering consultant, retired July 1 from the California Institute of Technology after 42 years as a faculty member. Professor Martel has served as consulting engineer for several Southern California cities, for the State of California, the U.S. Coast and Geodetic Survey and was a founder of the Earthquake Engineering Research Institute.

Eldon F. Matteson, recently appointed division manager of the new North Carolina division office of the Daniel Construction Company, will maintain offices in the Brown Building at 440 West Market Street, Greensboro, N. C. Until the change Mr. Matteson was Daniel's project manager on an aluminum reduction plant and aluminum rolling mill for the Reynolds Metals Company at Sheffield, Ala.

Andrew B. Holmstrom has retired as vice president of the Norton Company, Worcester, Mass., after 41 years with the company. Mr. Holmstrom is currently a member of the Worcester City Council, and was mayor from 1950 to 1954.

(Continued on page 34)



THE WILD N-III HIGH PRECISION LEVEL is universally accepted as the standard wherever absolute accuracy, dependability and ruggedness are paramount considerations. The N-III is easy and quick to set up and operate.

Three models are available to meet both field and industrial requirements, reading direct to .1 mm; .001 inch; .0005 ft.

All have tilting screw, coincidence level and built-in optical micrometer.

Write for Booklet N-III.

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INSTRUMENTS, INC.
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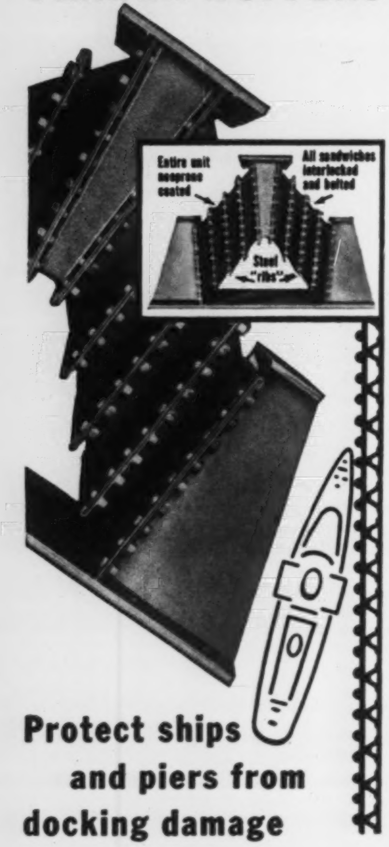
FULL FACTORY SERVICES

RUGGED RAYKIN FENDER BUFFERS


Entire unit neoprene coated
All sandwiches interlocked and bolted
Steel "ribs"
Protect ships and piers from docking damage

Here's a wonderfully-efficient dock fendering system, easy to install and inexpensive to maintain. Consisting of V-type arrangements of special rubber slabs bonded to tough steel plates, General's Raykin Buffers can be supplied, tailor-made, with deflection from 3" to 24" and energy absorption from 5,000 to 139,000 ft-lbs. Unaffected by corrosion, rotting, or aging, Raykin Buffers give positive, all-angle protection for harbor installations. Send the coupon for more information.

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Industrial Products Division
Wabash, Indiana

Please send information on Raykin Buffers

Name__________ Title__________
Company__________
Address__________
City__________ State__________

News of Members

(Continued from page 33)

Alfred A. Yee, formerly associated with Park & Yee, Ltd., as vice president and treasurer, announces the establishment of Alfred A. Yee & Associates at 914 Ala Moana Boulevard, Honolulu, Hawaii.

Donald W. Van Tuyl is leaving his post as assistant manager of the Natural Resources Department of the Chamber of Commerce of the United States, Washington, D. C., to take over new duties as executive assistant in charge of production of the Chamber's special publications. Prior to joining the National Chamber in 1952, Mr. Van Tuyl was for ten years hydraulic engineer with the U. S. Geological Survey in New England, Ohio, and Pennsylvania.

John C. Loos, Jr., has been promoted from engineer to assistant to the president of the American Well Works, of Aurora and Chicago, Ill. Mr. Loos has had considerable experience in the field of sewage and waste treatment and has been associated with the company for about six years.

Gene N. Burrell retired recently as hydraulic engineer in the Planning and Reports Branch of the Corps of Engineers' Fort Worth District after almost 29 years of service. He was first employed by the Corps from 1931 to 1933 as an inspector with the St. Louis, Mo., District, and from 1945 to 1950 as an engineer in the Galveston, Tex., District, transferring to the Fort Worth District upon its establishment in 1950.

William Samborski is now in the Water Supply and Pollution Control Division of the U.S. Public Health Service, Region 2, with headquarters in New York City. He is working on a Federal grant program for construction of sewage treatment facilities. Formerly he was associated with the Florida State Board of Health in Jacksonville, in charge of the administration of the Federal grant program for construction of sewage treatment facilities at the state level.

H. S. Smith has withdrawn as a partner in the Stanley Engineering Company, consulting engineers of Muscatine, Iowa, and Chicago, Ill., to do graduate work and research at the State University of Iowa, and eventually to teach. Since joining the firm in 1935, he has specialized in sanitary engineering.

W. J. Heard has become the new industrial engineer of Martin County, North Carolina. He has been assistant area engineer at Wilmington, Raleigh-Durham airport, Greensboro, High Point, Winston-Salem and Fort Bragg; first city manager of Kinston; and consulting engineer with Rivers & Associates, of Greenville. In the latter job he worked closely for five years with development projects in Martin County.

TIDE GATES

Five
12' High x 9' Wide
Type MMT Tide Gates
on Shockoe Creek,
Richmond, Va.

Engineers—
GREELEY & HANSEN
CHICAGO, ILL.

Contractor—
H. G. BOWLES
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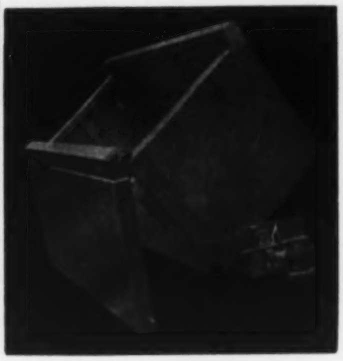

MAYO Tunnel Cars

. . . feature practical designs and rugged construction. All cars can be equipped with Mayo's safe, automatic couplers.

- **Side Dump Car** (shown) has 2⅓ cu. yd. capacity. 24" gage.
- **Rocker Dump Car.** Ideal for sticky muck or wet concrete. 1 cu. yd. capacity 24" gage.
- **Tunnel Car.** Box body is removable and may be hoisted to surface to be dumped into truck. ⅓ to 2 cu. yd. capacity. 18" or 24" gage.

FREE Bulletin No. 18-b shows car details; No. 21 illustrates Automatic Coupler.

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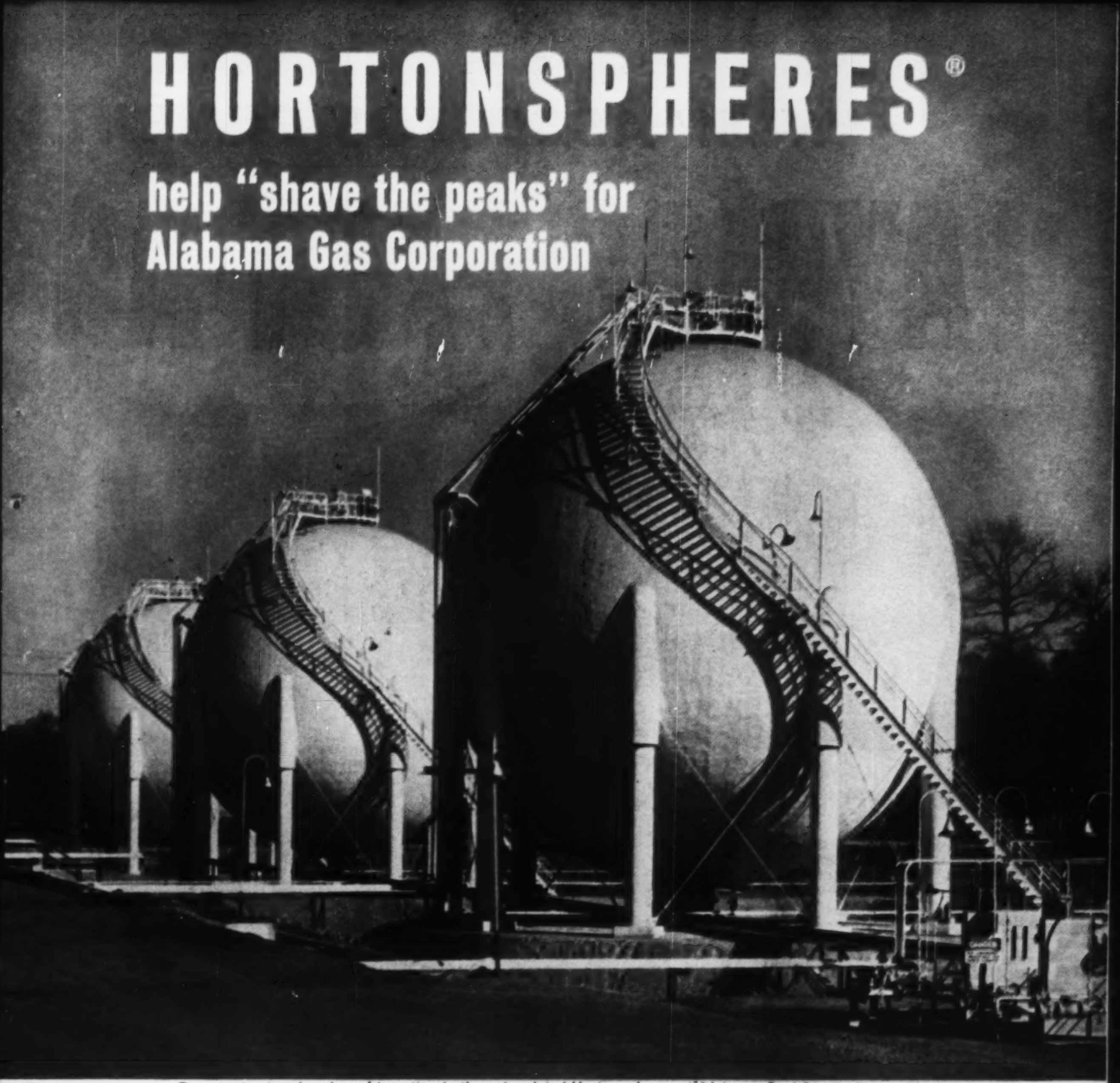
EQUIPMENT
LANCASTER, PENNA.



HORTONSPHERES®

help "shave the peaks" for Alabama Gas Corporation

Propane is stored under refrigeration in these insulated Hortonspheres at Alabama Gas' Birmingham peak shaving plant.

Alabama Gas Corporation supplies the natural gas that feeds the furnaces of 49 growing communities. When cold weather strikes sunny Alabama, the demand for gas skyrockets. This situation calls for "peak shaving" . . . the boosting of normal gas supplies to meet a temporary condition.

Three CB&I-built Hortonspheres are the heart of Alabama Gas' peak shaving facility. These vessels store some 36,000 barrels of liquid propane at 30°F. to 35°F. During peak periods, the propane is vaporized and further processed to make it compatible with natural gas and is then introduced into the gas distribution system.

Hortonspheres are used extensively for the storage of volatile liquids and gases under pressure . . . with or without refrigeration. Write our nearest office for full details.

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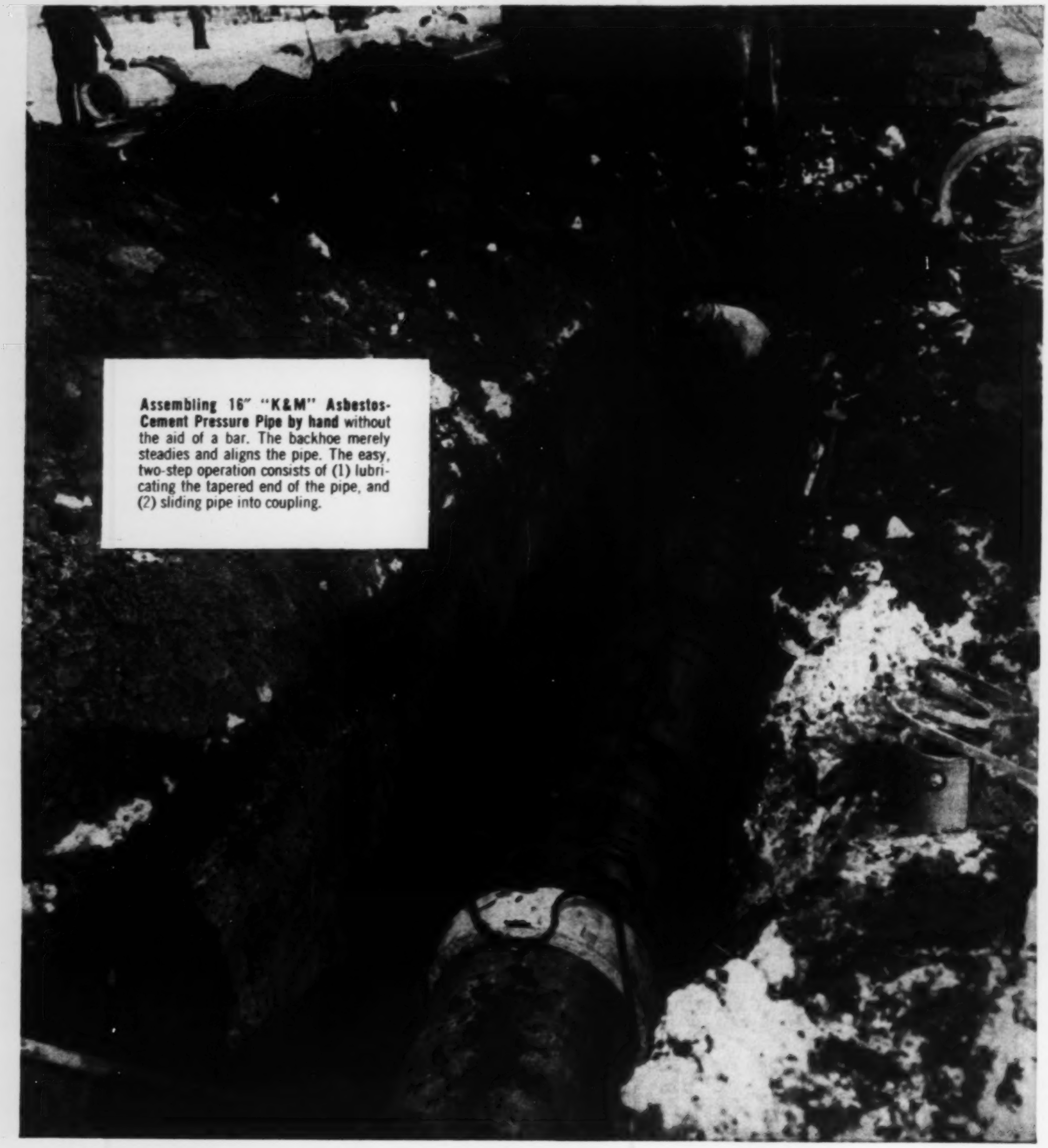
"‘K&M’ ASBESTOS-CEMENT

LAYS AS FAST AS



Assembling 16" "K&M" Asbestos-Cement Pressure Pipe by hand without the aid of a bar. The backhoe merely steadies and aligns the pipe. The easy, two-step operation consists of (1) lubricating the tapered end of the pipe, and (2) sliding pipe into coupling.

PRESSURE PIPE

A SHOVEL DIGS..."

G&B Construction, Inc., Youngstown, Ohio, installs 4½ miles of "K&M" Asbestos-Cement Pressure Pipe for the Austintown District of Mahoning County, Ohio

"You can lay 'K&M' Pipe as fast as a shovel can dig. There is nothing that will hold you back with this pipe. When you can lay a 16" water line, and it goes in as easy as an 8" water line, what more could you ask? They've got a good joint with that FLUID-TITE® Coupling . . . the pipe is wonderful to put together. There is no comparison between the FLUID-TITE Coupling and other couplings. Of all the 'K&M' Pipe we've laid, we never had a coupling break. Coupling breaks are very common with other pipe."

Those are the comments of Louis Gulfo, partner with Mike and James Bertilacci in G&B Construction, Inc. They installed "K&M" Asbestos-Cement Pressure Pipe in bitter cold, during February and March 1960. However, neither rain, snow, nor mud interrupts the installation of this modern pipe. The exclusive, patented "K&M" FLUID-TITE Coupling and the simple fitting procedures required make assembly easy.

Little or no maintenance will face Mahoning County, which built and will operate the system for a year, or the City of Youngstown, Ohio, which will then take it over. Being non-metallic, "K&M" Asbestos-Cement Pressure Pipe won't rot, corrode, or tuberculate, and is immune to electrolysis. The suppliers of this pipe were Trumbull Plumbing Supply Co., Warren and Youngstown, Ohio.

Now, in addition, you may use quality "K&M" Plastic Pressure Pipe in the same system with "K&M" Asbestos-Cement Pipe, if desired.

Write today for more information on "K&M" Asbestos-Cement Pressure Pipe to: Keasbey & Mattison Company, Ambler, Penna. Dept. P-1580.

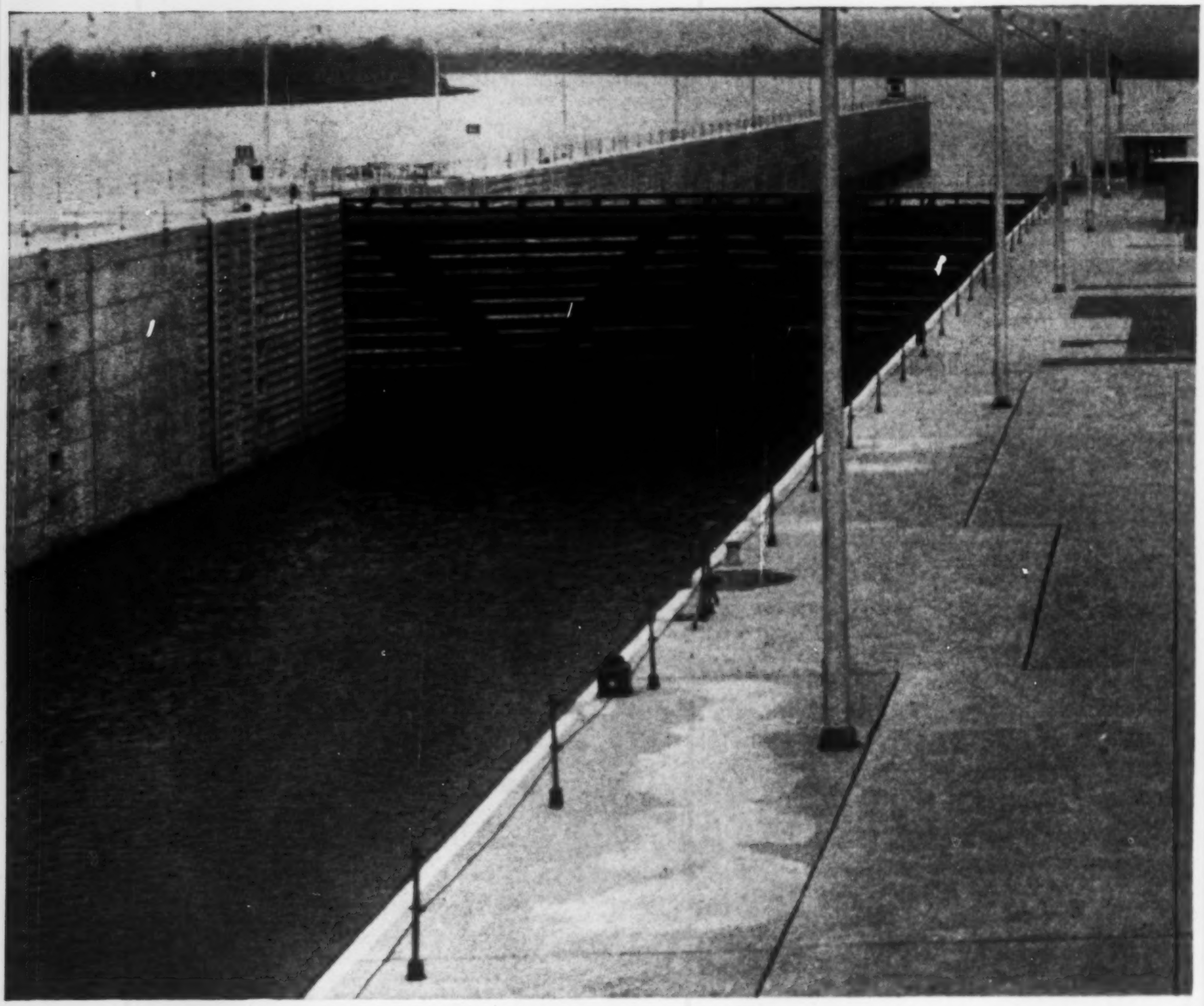
K·M
BEST IN ASBESTOS

Keasbey & Mattison at Ambler

Left to right: Louis Gulfo, G&B Construction, Inc.; Dale MacCleary, sales manager, Trumbull Plumbing Supply Co.; James Bertilacci, G&B Construction, Inc., Burke Lyden, Asst. Chief Engineer, Youngstown, Water Dept., Jim Bisciglia, Asst. Engineer, Mahoning County, and J. Henry Painter, Trumbull Supply Company.

3 miles of 16" "K&M" Asbestos-Cement Pressure Pipe were installed. Here, we see it ready for installation along Webb Road, in Austintown Township. In branching from the 16" water line, Mahoning County used 1 mile of 12" "K&M" Asbestos-Cement Pressure Pipe and ½ mile of 8" "K&M" Asbestos-Cement Pressure Pipe. Specifications call for 90 lbs. pressure when line is in operation serving 16,000 residents.

Gate Fabricator: Nashville Bridge Co., Nashville, Tenn. • Hoist Girder Fabricator: McNally Pittsburg Mfg. Co., Pittsburg, Kansas



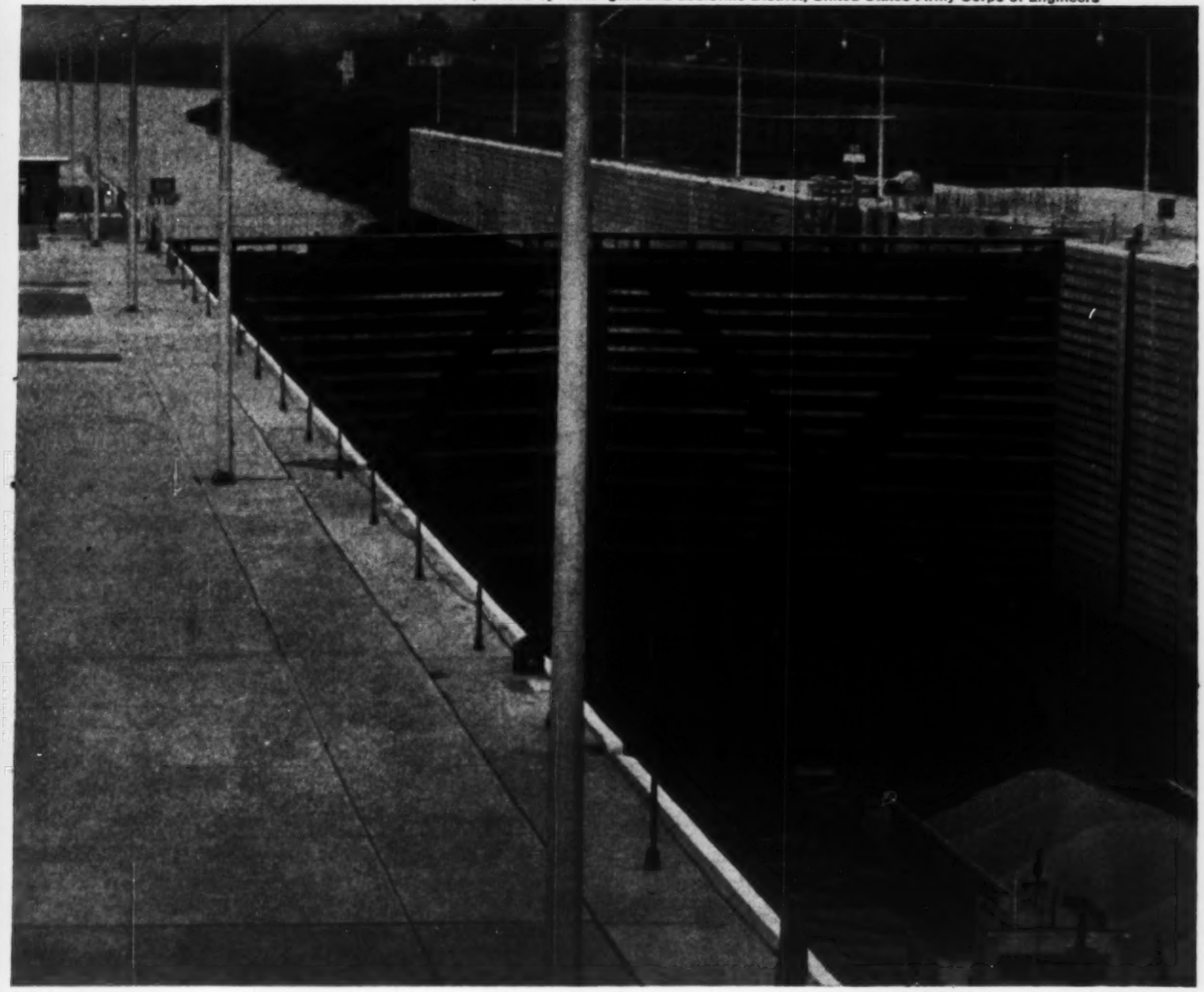
USS "T-1" Steel saves 289 tons

This is a story about how the tremendous strength of USS "T-1" Steel was utilized to save 289 tons of weight in the lock gates at the new Greenup, Kentucky and Markland, Indiana locks and dams on the Ohio River. Each lock gate has five diagonal braces that were designed for USS "T-1" Constructional Alloy Steel. At Greenup, it was estimated that 64 tons of "T-1" Steel did the work of 213 tons of carbon steel in eight gates. At Markland, shown in the picture above, 60 tons of "T-1" Steel were used instead of 200 tons of carbon steel to do the same job.

The diagonal units provide the supports which are absolutely essential to brace the gates. Each diagonal is a flat bar 8 inches wide by 1½ inches thick and about 73 feet long and weighs around 3,200 pounds. Toward the center of the diagonal is a turnbuckle used to adjust tension. By using USS "T-1" Steel, which has a minimum yield strength of 100,000 psi, both the size and weight of the diagonals were greatly reduced while retaining an ample factor of safety.

Lower costs. Reduction in weight because of the use of USS "T-1" Steel meant lower overall material costs, reduced shipping costs by more than one third and decreased handling and erection costs.

Greenup & Markland Lock and Dam Construction: Supervised by Huntington and Louisville District, United States Army Corps of Engineers



# of weight in 16 lock gates

USS "T-1" Steel for hoists. Four hoists for the emergency gates at Greenup locks and dam were also built of USS "T-1" Steel by McNally Pittsburg Mfg. Co., Pittsburg, Kansas. The structures are girder sections about 25 feet long and 41 inches deep. Flanges are 20 inches wide by 2½ inches thick. The webs are 36 inches deep by 1¼ inches thick. All were fabricated from "T-1" Steel plates. Each girder weighs about 12,000 pounds.

The new locks and dam on the Ohio River at Greenup, Kentucky were built under supervision of Huntington, W. Va. District, U. S. Army Corps of Engineers. A similar set of locks at Markland, Indiana was built under the Louisville District, U. S. Army Corps of Engineers.

Other uses of USS "T-1" Steel in construction. Wherever great strength is needed with least weight, such as in bridges, TV towers, pressure vessels, and high pressure penstocks, USS "T-1" Steel is unsurpassed because of its high yield strength, high resistance to impact abrasion, and weldability. For complete information write for our "T-1" book. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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National Tube – Pittsburgh
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
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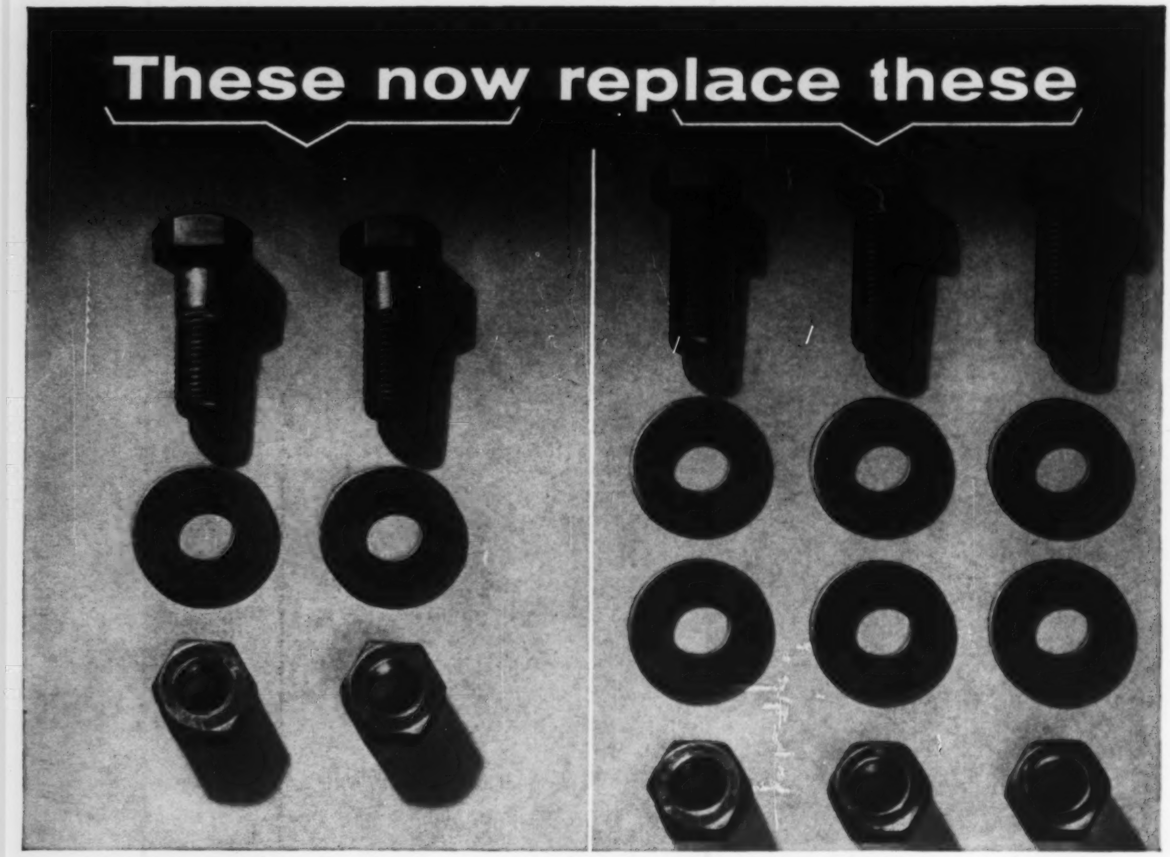
United States Steel

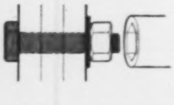
This mark tells you a
product is made of modern Steel.



How you can cut structural steel costs with new design RB&W High Strength Bolts

In any type joint, you save one hardened washer out of every two by using RB&W High Strength Bolts with new head and thread design.

But in bearing joints – the majority of all structural steel connections – the savings really soar. For you also eliminate one fastener out of every three formerly required . . . regardless whether they were rivets or regular high strength bolts.



This sketch shows why. The new bolt has shorter thread length. Shear planes pass through full shank section only, thereby enabling the full, allowable shear strength of the bolt to be utilized. The new larger head furnishes extra bearing area to prevent crushing when bolt is torqued up to its full recommended tension. Only one washer is needed . . . under head or nut whichever is rotated in wrenching.

The AISC approves this fastening breakthrough. It has been fully tested and approved by the Research Council on Riveted and Bolted Structural Joints. The sooner that structural engineers work it into their new designs, the sooner everybody benefits. Building owners benefit through lower costs; construction shop fabricators benefit through more tonnage assembled faster with existing shop space; erectors benefit through fewer holes to fill and less material cost.

Consult us for more details on these bolts that have *certified* quality. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

RB&W
116th year

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

LARGEST INDEPENDENT PRODUCER OF HIGH STRENGTH BOLTS FOR CONSTRUCTION

. . . . . Am-Soc Briefs

▶ ▶ Reno Convention — a winner. . . . Water — its usefulness, its destructiveness, its lack and its abundance — was the subject of more than half of the some 100 technical papers presented at Reno. Professional matters up for discussion included the recent transitional developments in mapping practice and their effect on obtaining photogrammetric mapping services. A symposium in which all sides of the problem were aired attracted a large group of engineers both from private practice and from government agencies.

▶ ▶ United Engineering Center topped out. . . . On July 26, just three months after placing the first steel, the erection crew topped out the United Engineering Center. Still waiting to "top out" are 38 Local Sections who have not yet reached their quotas in the UEC Fund drive. Less than $16,000 lies between ASCE and success in the drive — your contribution may put ASCE over the top. SEND IT NOW.

▶ ▶ Conference on Civil Engineering Education leaves a lot to be done. . . . Little formal action was taken by the 250 educators, practicing engineers and industrialists who attended the three-day meeting financed by the National Science Foundation and sponsored by ASCE, The Cooper Union and ASEE. While some were disappointed in the lack of direct accomplishment, others were quite encouraged by apparent agreement among delegates that now is the time for action. A news report of the conference is on p. 106. A condensation of one paper, p. 80, outlines a plan for professional engineering schools, similar to medical schools for practitioner-oriented advanced courses. This would parallel rather than replace the research-education oriented courses of the graduate school.

▶ ▶ Boston Convention — Oct. 10 to 14. . . . An outstanding technical, professional and social program (see p. 83) offers a variety of activities to interest every member of ASCE. With the meeting featuring Research and Urban Renewal — Boston's the perfect spot. Plan now to attend — and of course wives are welcomed.

▶ ▶ Computer Conference. . . . Second National Conference on Electronic Computation meets in Pittsburgh next month — Sept. 7-9. In conjunction with the meeting there will be computer demonstrations featuring some items which will be on view for the first time. Circle your calendar and plan to be in Pittsburgh for this meeting. See program on p. 94.

▶ ▶ Planning for fall meetings is well under way in most Local Sections, Branches and Forums. If you have ideas for an interesting program or a good speaker, now is the time to share them with your local program chairman. If you do not have his name call your secretary or president. They will be glad to have your suggestions for meetings of your local group.

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We are proud to announce a contribution of outstanding importance to concrete technology – ZEECON lignin sulfonate dispersants and water reducers–*specifically designed and produced* for use in concrete additive formulations.

Subjected to rigid controls throughout manufacture, ZEECON offers many valuable benefits to both the admixture formulator and concrete user:

- Reduces water requirements by 10 to 20%
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Formulations based on ZEECON are offered in both set-retarding and non-retarding grades. Some ZEECON based formulations are also available with and without added air entrainment.

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To insure uniform results on the job, each production lot is checked for performance in actual concrete mixes and for chemical analysis.

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Found to add outstanding strength and durability to finished structures, ZEECON formulations have already been used in millions of yards of concrete on important construction projects. We urge you to specify additives which contain a ZEECON for your next job.

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ChemCon
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Econo-MIX
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EZ-POUR
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do you know that

New York has more office building space than any other city in the world? With first-class office space at a premium by the end of the war, the city began an unprecedented building program. Between 1947 and 1959, there was completed 33,676,000 sq ft of rentable area, and an additional 11,476,460 sq ft of space is currently under construction for completion in 1960 and 1961. With thirty more major office buildings projected, it is obvious that what started as a building boom has developed into a solid trend. Among new structures planned are the 55-story Grand Central City, a 50-story building to go up at 277 Park Avenue, and a 42-story U.S. Government building to be located on Foley Square.

■ ■ ■

The U.S. will join with Mexico in building Amistad Dam on the Rio Grande? Recent Congressional approval has been given U.S. participation in the project. The $100 million dam will be the second of three proposed for flood and siltation control and power by the two nations. (Falcon Dam, the first, was completed in 1953.) Amistad Dam will be located 300 miles upstream from Falcon and will have a total storage capacity of 5.6 million acre-ft. The U.S. share of the cost will be almost $72 million.

■ ■ ■

The steel output for the first half of 1960 was the third highest on record? The six-month total of 60,743,222 tons was the third highest for any half-year on record, despite the slump in production that began in April. Better first-half records were set in 1959 and 1956. Reasons for the present cutback in use and output of steel are discussed in the News Briefs section.

■ ■ ■

The nation's toll roads are paying off? Even roads like the Massachusetts and Ohio Turnpikes and the Northern Indiana Toll Road, which got off to poor starts, are reported to be in the black with receipts continuing to rise. The situation assures a backlog for maintenance, or for retiring bonds ahead of schedule. This information comes from the June issue of "Views of a Consulting Engineer," which says that toll facilities, "like any other type of business do not build up sales overnight. Promotion is needed."

■ ■ ■

Work is about to start on the world's largest solar telescope? The instrument—to be built at the Kitt Peak National Observatory near Tucson, Ariz., under a $4,000,000 grant from the National Science Foundation—will have a focal length of 300 ft, and is expected to form images of the sun several times larger and more brilliantly illuminated than are obtainable with any existing equipment. It will consist of three reflecting surfaces, requiring a support structure about the size of a ten-story office building. The objective is a much more detailed study of the sun than has been possible up to now.

■ ■ ■

The population of the earth has increased from 500 million in the 17th century to about three billion? China, the great enigma, leads with over 600 million, and India is next with about 400 million. The U.S. finds itself with 180 million and with 130 cities with a population of 100,000 or more. Twenty-seven on the list have achieved this status since the 1950 census, and four that were on the list in 1950 have dropped out.

■ ■ ■

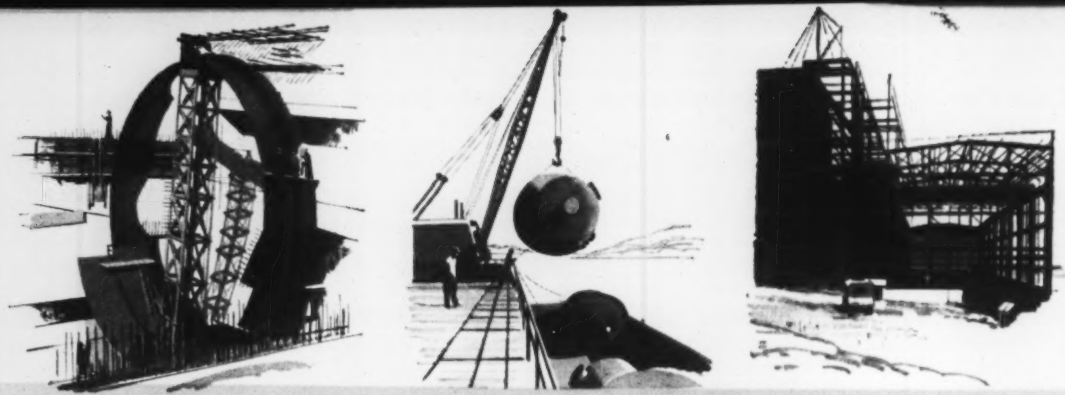
The U.S. will ultimately have to depend on the ocean for part of its water supply? The nation's daily water needs by 1980 are put at about 500 billion gallons—a 70 percent increase over our present needs—in a recent Department of Commerce study. Indicative of the growing interest in converting salt water is recent Congressional legislation giving the Department of the Interior $4,000,000 a year for its Office of Saline Water for the next five years. The office, which has been in operation since 1952, is now spending less than half that amount. The principal (and actually only) problem of course is to bring costs within the present price range for water of around 30 cents per thousand gallons.

■ ■ ■

Monument-conscious Washington is about to get two more? They are a monument to Woodrow Wilson (site and type to be selected by a commission) and a $900,000 monument to Theodore Roosevelt, on Roosevelt Island in the Potomac. The move to build the controversial "Freedom Wall," proposed for construction adjacent to Arlington Cemetery, has been blocked by Senate action. The proposed wall—over 500 ft long, 200 ft wide, and 58 ft. high has been strenuously opposed by local interests as a "monstrosity."

■ ■ ■

More than one-fifth of the Interstate Highway System is now open to traffic? Of the 8,855 miles now in use by motorists, 3,442 miles have been completed to standards adequate for 1975 traffic, and 3,139 miles are adequate for present traffic. Toll roads, bridges, and tunnels incorporated in the system, as permitted by law, totaled 2,274 miles. About $8 billion has been spent on the program since its start four years ago. Figures are from the Bureau of Public Roads.



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CIVIL
ENGINEERING

THE ENGINEER AND POLITICS

GEORGE D. CLYDE, F. ASCE, Governor of Utah

From his address before the General Membership Luncheon, ASCE Reno Convention

Americans have come to regard the professional engineer as a man set apart from politics. People from virtually every other walk of life participate in the affairs of government, and their participation is accepted as normal. Yet when an engineer participates actively in politics and government, he is looked upon as a rarity and almost a freak. There have been some notable exceptions, of course, of whom Herbert Hoover is the outstanding example. Nevertheless, the engineer continues to be an oddity in public life.

Perhaps one of the reasons for this is that the profession of engineering itself is comparatively young, and by the time it became thoroughly established our traditions of government had been formulated.

Leadership in critical fields

If one profession predominated in the establishment and direction of our early government, it was the law. This was logical and proper. Of course much was contributed by men without legal training, whose natural wisdom and rich background of experience provided invaluable counsel. Yet legal training and an understanding of the basic principles of the law are most helpful to holders of executive office in government, who are charged with the administration of the laws of the land.

Every branch of our government should represent a cross-section of our population, and particularly leadership in the fields that most critically affect the over-all advancement of our economy. This representative balance was maintained in our early days, with results that speak for themselves. It is essential today if we are to maintain a balanced growth.

This is not merely my own thinking, but an opinion shared by many earnest and informed students of government. A recent Rockefeller Foundation report on education in America stated:

"The conduct of government depends heavily on the talents of the economist, the agronomist, the engineer, the public health officer and other experts. . . . The increase in specialization in our society demands more technically trained people at policy-making levels."

This last statement is particularly important. We do have an abundance of technically trained people, including engineers, serving every level of government in America—in a staff capacity. This in itself is excellent, and essential in our complex society. But when the technically trained people serve at staff level only, and are not adequately represented at policy-making levels, serious danger threatens.

When the engineer is content to remain at staff level, it is somewhat as though a first-rate engineer agreed to design and build a complicated bridge—and place it on a site selected by a layman, where the foundation might be woefully insecure. A good engineer would never do that in professional life, but that is what the whole engineering profession is doing when it concentrates solely on the professional level, and declines to raise its head occasionally for a comprehensive view from the policy-making heights.

Spending for education

Let me sketch for you some of the major problems with which I have come face to face since taking elective office for the first time some three and a half years ago.

The largest single area of state government expenditure in Utah—and, I imagine, in most other states—is education. It is of vital concern to all of us, not only because it so closely touches the welfare of our children, but also because the quality of the education our children receive today will largely determine the future of our country, and of all the free world, tomorrow.

An educational problem which Utah shares with the rest of the nation is the overcrowding brought about by the tremendous increase in school-age populations. It is difficult to erect school buildings fast enough and to find the money to finance them.

Getting adequate classroom space

In Utah, we have long had a statewide system of school finance equalization which applies to the operation and maintenance of our public schools, but we have regarded capital construction as a matter to be handled by the local school districts. However, because the explosion in school-age populations is not evenly distributed but tends to be concentrated in certain areas, it has been necessary for a number of years for the state to furnish emergency aid for school construction. In view of the acute shortage of classrooms, I have been keenly interested in how money for school construction is being spent. I have found many shocking examples of waste, with too much money being spent on fancy decorations, on lavish auditoriums and spectator capacity for gymnasiums, on elaborate halls and corridors, all of which subtract from the net amount of usable classroom space. I have also found some splendid examples of intelligent construction, providing a maximum of modern, well lighted, adequately equipped classroom space for each dollar spent.

Needed—the engineering approach

The state very properly has nothing to say about how the residents of any school district decide to spend their own money for school construction. But when the state is furnishing all or part of the money, we have a responsibility to see that the funds are wisely spent, and I am doing my best to focus public attention on this vital problem. And I am certain that my training in engineering has helped me to evaluate the basic construction problems we are dealing with.

This nation is currently engaged in the largest public works program ever attempted in the history of the world, the 50-billion-dollar system of interstate and defense highways. Utah is in the midst of this construction, along with its permanent program for primary and secondary highways.

When I took office at the beginning of 1957, I discovered some large problems which stemmed from lack of understanding at the policy level of the magnitude of many of the technical engineering problems that were being dealt with at staff level. Utah had made no start whatever on the interstate program. In many of the state's newest and most modern highways, there are serious errors in design which will be extremely costly over the years. They occurred because, in a misdirected effort to economize, inadequately trained people were given assignments beyond their capacities. There were actual cases of multi-million-dollar projects being planned and directed by $400-a-month engineers, who certainly could not be blamed for failing to measure up to the standards of professional men commanding three or four times their salary. Utah is now paying reasonable salaries for professional engineering talent in its road department and is getting the results that might be expected. Over the years, the saving to the state will be many times the money spent to hire truly professional talent.

Water, vital problem

Over all the semi-arid and arid areas of the West and Southwest, water is a vital problem—the ultimate limiting factor in our development. Utah has an agency known as the Water and Power Board, which assists local groups with the development of water projects which are either too large and complex for their own limited resources, or too small for inclusion in the federal reclamation or even the small projects programs. Incidentally, my own connection with state government, before running for elective office, was as director of the Water and Power Board. Since taking office as governor, I have found my engineering training invaluable in understanding the broad objectives of the Water and Power Board program and in supporting before the Congress the state's interest in water development programs.

In Utah, the state engineer has a position of great responsibility. He is charged with determining water rights and priorities—from both aboveground and underground sources—in all parts of the state. Much of the work of the state engineer's office had fallen deplorably in arrears, but we have been fortunate in securing the services of one of the world's outstanding water engineers, Wayne D. Criddle, and we are making real strides toward catching up and developing a comprehensive picture of the state's full potential of water development and use.

On the national scene, the need for the engineering approach and understanding is even more evident. We are all too keenly aware of the tremendous international tensions which have recently been further intensified. We realize the frightful danger of a major war in this nuclear-space age, when modern weapons are capable of destroying civilization itself. We know that if we are to preserve the peace—as we must—it is essential that we maintain an arsenal of weapons and a military establishment sufficiently formidable to deter a potential aggressor. This is basically a scientific and engineering problem.

If, as we all hope, we are able to avoid a shooting war, we know we shall be engaged in a relentless struggle between the forces of freedom and of totalitarianism that will continue until one side or the other achieves decisive superiority. To win, we must excel in technological advancement and sustained production—once again, problems in science and engineering. When I visited the Soviet Union last summer, I was impressed that the national goal everywhere was to out-produce America in every essential line of endeavor. Ultimately, our survival is as much at stake in a cold war as it would be in a hot one.

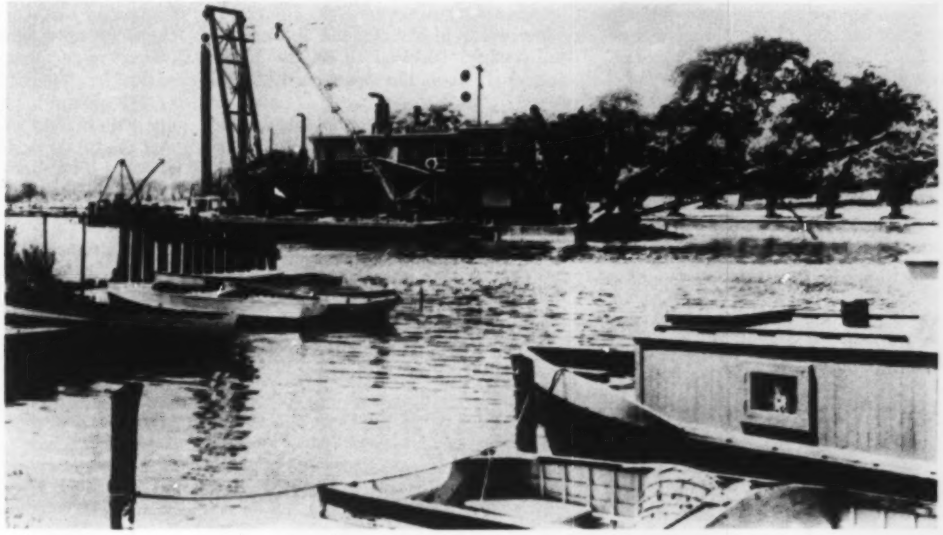
I am not suggesting that we develop a national leadership composed exclusively, or even preponderantly, of scientist-engineers. That would be as unbalanced and as dangerous as to have a leadership made up of any other single group. I am, however, suggesting—and most earnestly urging—that scientists and engineers recognize their civic duty as thoroughly as they recognize their professional responsibilities and take a proportionate part in the affairs of politics and government.

The greater structure, a free society

We all know the magnificent, esthetic thrill of contemplating a fine piece of engineering—whether it be a skyscraper, a bridge, a dam that controls a mighty river or a rocket capable of traveling to the moon. The pride of accomplishment of those who have been privileged to contribute their professional talents to the final production is immense.

How much greater the thrill of honest pride if we can contribute to a still greater structure—the structure of a free society, which permits man to accomplish the great works of which he is capable, to maintain his dignity and his freedom of choice.

Each of us has his own professional ambition and aim in life. We share the far greater and more important aim—to keep the light of liberty forever burning in the world.



The "Shinnecock," a 12-in. hydraulic pipeline dredge owned by Suffolk County, New York, has made an important contribution to a variety of local development projects.

Dredge ownership boosts county program

ALBERT CASS, Commissioner of Public Works, Suffolk County Public Works Department, Yaphank, N. Y.

Each year, thousands of tons of sand, silt and gravel are eroded by the action of tides and weather and settle at the bottom of Long Island's channels and bays. These waters then become clogged. The necessity of keeping them free and clear has been a constant problem to the officials of Suffolk County, New York.

To solve it, the County in 1956 contracted with the Ellicott Machine Corp. of Baltimore, Md., for the purchase of a 12-in. (diameter of discharge pipe) heavy-duty hydraulic pipeline dredge. This dredge, christened *Shinnecock*, was put to work on various channel clearance projects in September of that year.

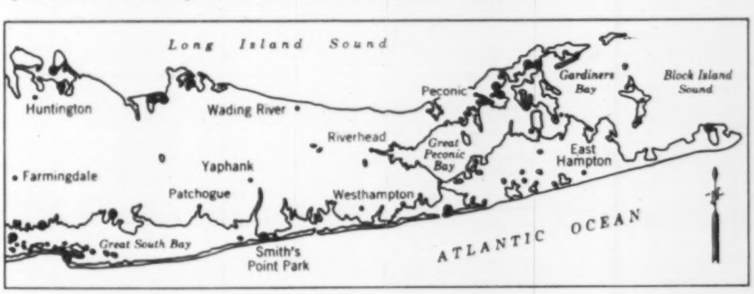
Since then, possession of the dredge has given a tremendous boost to public works developments in the County. Its availability has created a widespread demand for the completion of certain projects, and each township has requested the use of the dredge for a number of jobs. County officials report that the dredge has made possible the completion of 22 different projects (Fig. 1) primarily for marina development, placing of beach fill, and dredging of channels.

Many thousands of dollars have been saved because the County has been able to do its own dredging. The work probably could not have been done at a lower cost per cubic yard than has been obtained over the past three years, even though the figure includes *all* operational costs for the dredge.

Such savings have meant a steady return on the County's dredge investment in terms of work accomplished. It is doubtful whether this amount of work could have been done in the same period if there had been the complications that arise when it is necessary to wait for the proper equipment. For Suffolk County—the dredge is always on hand.

An additional advantage is that

FIG. 1. Twenty-two projects in Suffolk County, Long Island, have been completed since the dredge "Shinnecock" was commissioned by the County. The work has been mainly for marina development, beach fill, and channel clearance.



dredging operations are more flexible since the working of the dredge can be modified to meet unforeseen problems. Time limits and certain specific operating factors are involved in scheduling the work of equipment from outside sources. If the schedule becomes difficult to meet because of unexpected problems, completion of a job may be delayed.

A good example

The *Shinnecock's* major job has been the creation of Smith's Point Park on Long Island Sound between Narrow Bay and the Atlantic Ocean, begun in January of 1957. Dredging of these waters was seen as having a dual purpose—deepening of the channel and use of the dredged material to fill the holes and depressions that pockmarked the island.

As a result, this once swampy, pitted, half-submerged finger of land has become one of the most beautiful beaches in the New York area. Joined to the mainland by a newly built bridge, it is expected to receive thousands of shorebound vacationists this summer. It will offer a bathing beach, bath houses, restaurants and parking facilities for 3,400 cars.

The "face-lift" was a swift operation. Channel dredging and land fill were completed in five months of around-the-clock operation. In all, over 800,000 cu yd of fill were deposited in the park area. The 512-acre site consisted of 273 upland acres and 239 acres under water. These latter were dredged and the fill deposited on the park area, giving it a level height of approximately 7 ft above mean sea level on the bay side and 17 ft on the ocean side.

Other projects

In September 1957, Shinnecock Bay was the site for the rebuilding of 5,000 lin ft of dunes east of the inlet to avert undermining of the $1,000,000 east jetty. For this, 344,000 cu yd of

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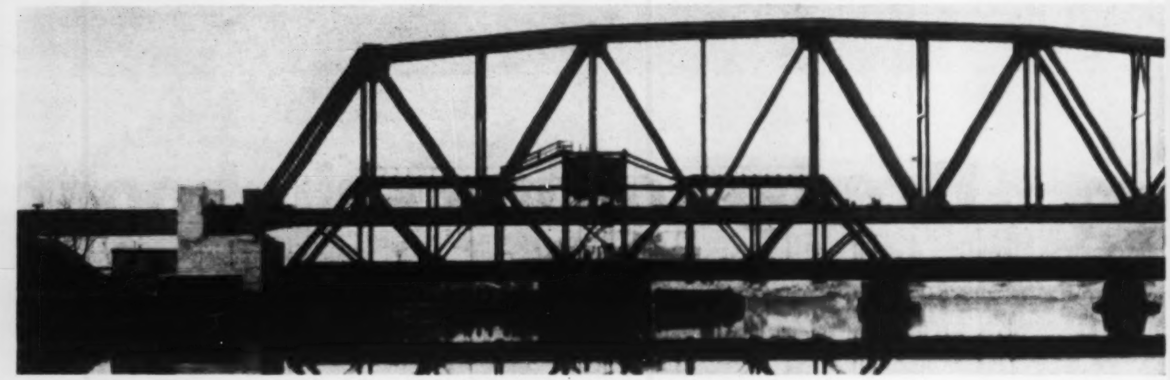


Bridge dismantled without falsework

The job of dismantling the existing swing span was included in Bethlehem Steel Company's contract to fabricate and erect steel for the new bridge of the Michigan Central Railroad Company at Calumet City, Ill. It was decided that the old bridge could be dismantled without using falsework if care were taken not to unbalance the span excessively.

Bethlehem had just completed a 310-ft through truss bridge 150 ft upstream of the old span. The new truss has a 25-ft minimum clearance over the Little Calumet River, sufficient for existing barge traffic. Should future river traffic warrant it, provision has been made to convert the new bridge into a lift span with a high clearance.

The old swing span was balanced over a turntable located at its midpoint. By placing blocking beneath the floor beams, located 10 ft 0 in. on each side of the midpoint, and removing steel from each end, one panel at a time, the center of gravity of the structure was kept between the blocking points. See Fig. 1.

Dismantling procedure

Engineers of the erection department reasoned that by removing one panel of steel at a time from each end, the eye-bars in the top chord would remain in tension. If falsework were used beneath the bottom chord, the top-chord eye-bars would be put into compression, which they are incapable of taking. Suitable stiffening of the eye-bars as well as erection of falsework would have entailed needless expense.

Crawler-crane capacity limited the maximum weight of an individual piece to 12½ tons. By removing no more than one panel (the distance between the vertical members of a truss) from each end at a time, there was no danger of overturning the structure. The order of dismantling the members was dictated by the condition that all the remaining steel would be stable.

The crawler crane hooked onto each

silt were pumped into the dune area from a channel dredged 12 ft deep, 6,500 ft long, and 200 ft wide.

After this, the south approach to Smith's Point Bridge was rebuilt. In just six weeks, 252,000 cu yd of sand were relocated in that particular area. Successive projects at Oak Beach, Amityville, Copiague and Islip resulted in safe channels and improved facilities for small-boat navigation.

Through December 1959, 3,665,000 cu yd of material had been dredged. A combination of sand, mud, and small gravel has been pumped through pipelines up to a maximum length of 6,500 ft.

Specific quantities are:

Sept. 1956 through Dec. 1957, 1,600,000 cu yd

Jan. 1958 through Dec. 1958, 1,060,000 cu yd

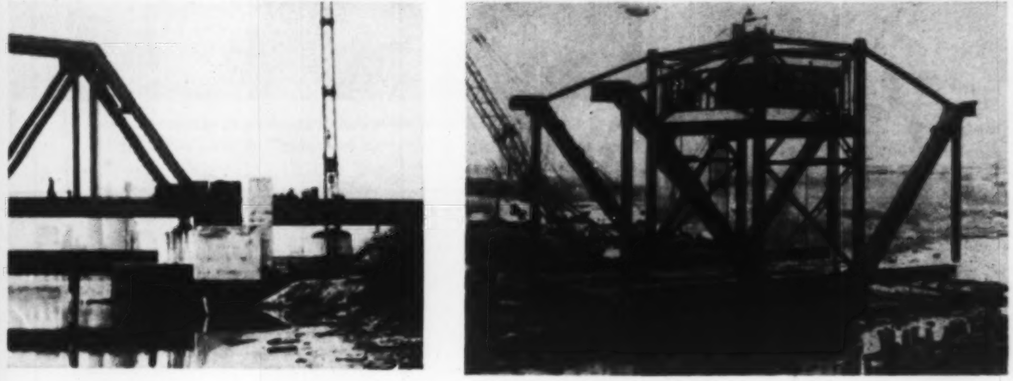
Jan. 1959 through Dec. 1959, 1,005,000 cu yd

This dredge has worked 24 hours a day, five days a week during all this time, with Saturday set aside for any necessary repairs. There has been no serious down time since the dredge went into operation.

The operational cost, over the past three years, has averaged approximately 35 cents per cu yd. This figure includes all costs relating to the dredge, such as amortization of equipment, labor charges, and replacement of spare parts. This is a completely satisfactory figure to the County, taking into consideration the fact that the dredge has had to be moved fairly often, since some of the scattered jobs were of short duration. These conditions would have made the dredging work inconvenient and more costly to perform by other means.

Thus during the past three years the 12-in. hydraulic pipeline dredge, *Shinnecock*, belonging to Suffolk County, New York, has proved that reliable dredge performance can make a positive contribution to a variety of local development projects.

* * *



At far left, new railroad bridge over Little Calumet River is in foreground, span that was dismantled, in background. In near view, old bridge has been partially dismantled.

truss member in the order in which it was to be removed. Ironworkers then burned each end free, burning slowly to avoid sudden parting at the cut. It took 14 days to complete dismantling in this manner.

Before dismantling began, the span was turned to the open position to permit passage of river traffic. A level area along the shore, parallel to the truss, was bulldozed to make room for the operation of a crawler crane of 50-ton capacity. As steel was burned loose, it was loaded onto railroad cars spotted on a nearby siding for this purpose.

When the truss had been dismantled, the heavy steel turntable was cut into 30 pieces for removal.

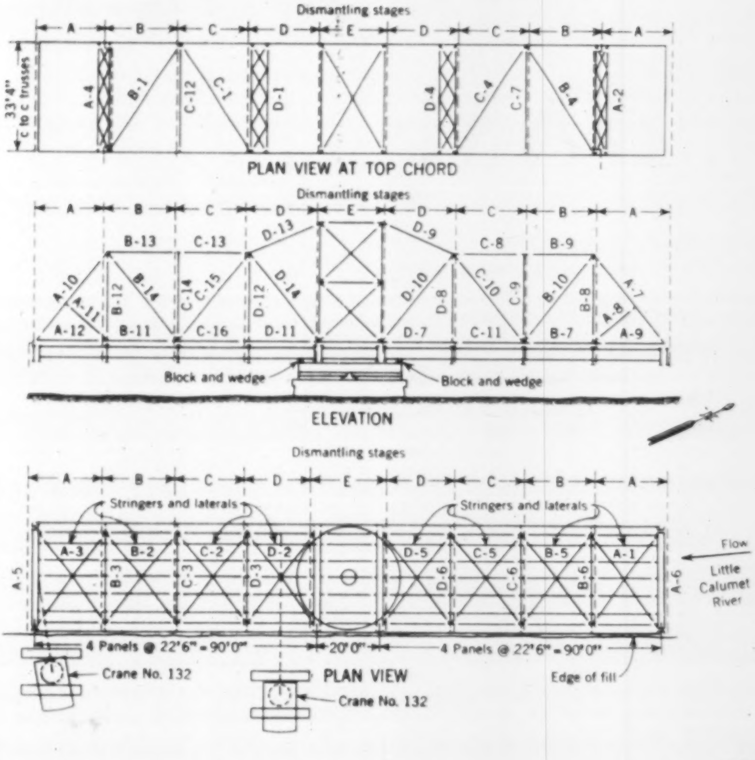

Dismantling stages
A B C D E D C B A
33'4" c to c trusses
A-4
B-1
C-12
C-1
D-1
D-4
C-4
C-7
B-4
A-2
PLAN VIEW AT TOP CHORD
Dismantling stages
A B C D E D C B A
B-13
C-13
D-13
D-9
C-8
B-9
A-10
A-11
B-12
B-14
C-14
C-15
D-12
D-14
D-10
D-8
C-10
C-9
B-10
B-8
A-7
A-8
A-12
B-11
C-16
D-11
D-7
C-11
B-7
A-9
Block and wedge
Block and wedge
ELEVATION
Dismantling stages
A B C D E D C B A
Stringers and laterals
Stringers and laterals
A-3
B-2
C-2
D-2
D-5
C-5
B-5
A-1
A-5
B-3
C-3
D-3
D-6
C-6
B-6
A-6
Flow
Little Calumet River
4 Panels @ 22'6" = 90'0"
20'0"
4 Panels @ 22'6" = 90'0"
Crane No. 132
PLAN VIEW
Crane No. 132
Edge of fill

FIG. 1. Truss swing span of Michigan Central Railroad at Calumet City, Ill., was dismantled without the use of falsework, proceeding from both ends simultaneously, that is from A-A to B-B, etc.

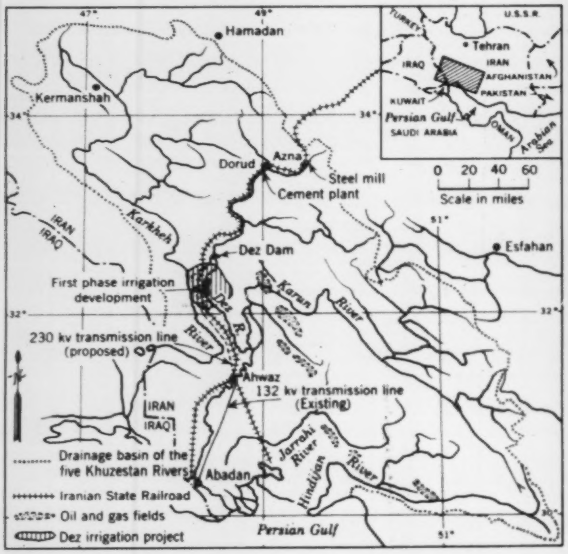

47°
49°
Hamadan
Kermanshah
34°
34°
U.S.S.R.
TURKEY
Tehran
IRAQ
IRAN
AFGHANISTAN
KUWAIT
PAKISTAN
Persian Gulf
SAUDI ARABIA
OMAN
Arabian Sea
Dorud
Azna
Steel mill
Cement plant
0 20 40 60
Scale in miles
IRAN
IRAQ
Karkheh
51°
Esfahan
Dez Dam
First phase irrigation development
Karun
River
Dez
R.
32°
32°
230 kv transmission line (proposed)
River
Ahwaz
132 kv transmission line (Existing)
IRAN
IRAQ
Drainage basin of the five Khuzestan Rivers
Jarrahi River
Hindijan
River
Abadan
Iranian State Railroad
Oil and gas fields
Dez irrigation project
Persian Gulf
51°
30°

FIG 1. The Dez area of Khuzestan. The Khorramshahr-Tehran Railroad will carry supplies to Andimeshk, where a 22-mile highway connects with the dam site. The cement plant will supply the dam and the steel mill will use power from it. The 132-kw transmission line carries only limited power now.

Dez Canyon is seen from upstream before start of construction. Note tent for scale.

Iran's DEZ DAM

W. L. VOORDUIN, M. ASCE

Engineering Director, Development and Resources Corporation, New York, N. Y.

President, Regional Development Engineering Corporation

Dez Dam, a thin-arch structure 630 ft high in a deep and narrow gorge in southwestern Iran, is now under construction to provide for irrigation, flood control, and power. This project, located 90 miles north of Ahwaz, is a key project in the development program planned for the Khuzestan area. The program comprises some 14 river projects, several thermal stations, and associated transmission lines.

The regulated flow of the Dez River available for irrigation will be around 7,300 cfs, about four times the minimum natural flow and sufficient to irrigate about 360,000 acres. Operation of the Dez Reservoir will reduce flood flows to the extent that the Dez and Karun Rivers, below their confluence, will remain within their banks in all except the most severe floods. The ultimate power generating capacity provided amounts to 520,000 kw, of which 130,000 kw will be installed initially.

The Khuzestan area, in former days a major granary of the Middle East, presents an unusually favorable setting for a regional plan for the long-range development of land, water and mineral resources. It is traversed by five rivers—the Karun, Karkheh, Dez, Jarrahi and Hindijan. Over the years, the lack of proper drainage of irrigation water and inadequate drainage of flood waters, coupled with high intensity of evaporation, has increased soil salinity to the point where a drastic reduction in crop production has resulted, with consequent impoverishment of the population.

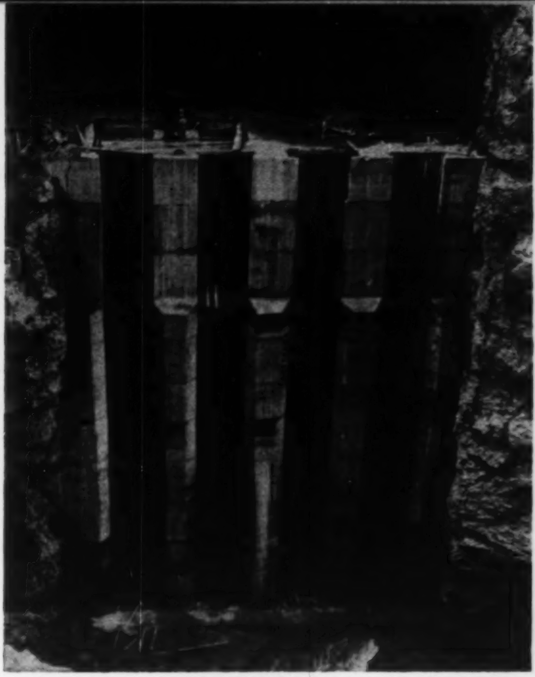
The area is plagued with floods resulting from melting snows and spring rains in the Zagros Mountains to the north, which cause losses to cities, villages and farms. Flood damage is estimated to average about one million dollars annually under present conditions. The area suffers from a severe power shortage. What power is available is produced generally at high cost in small diesel stations.

Early in 1956, the Plan Organization of the Government of Iran invited David E. Lilienthal and Gordon R. Clapp, both former chairmen of the U. S. Tennessee Valley Authority, to visit Iran and to investigate the development possibilities of this area of roughly 60,000 sq miles in the southwestern part of the country. To carry out this responsibility, the Development and Resources Corporation, a firm headed by Messrs. Lilienthal and Clapp, organized the Khuzestan Development Service to function as its agent in Iran.

In the early summer of 1956, when aerial reconnaissance first revealed the promising possibility of a major river control project on the Dez River, there was no means whatever of access to the site. A temporary jeep road to the plateau above the dam site was constructed so that site investigations could commerce.

The river bed at the dam site is some

Plant for first concrete pour is seen in canyon, above diversion tunnel intake. Access road has been cut in canyon wall.



Diversion tunnel intake, 101.7 ft high, was complete in January 1960 except for minor stripping and clean-up.

40 ft wide and both sides rise on a slope of approximately two vertical on one horizontal to a height of about 1,400 ft above the river bed. The dam foundation, underground powerhouse and associated structures on the west bank, as well as the spillway structure and tunnels on the east bank, will be entirely in a massive conglomerate, the so-called Upper Bakhtiari conglomerate, which in this area has a thickness of 1,500 to 2,000 ft. This formation has few joints, no faults, and no seams or cavities. A small percentage is pervious and requires grouting.

The first major construction activities at the Dez dam site were: (1) work to provide access from the level of the plateau at El. 1,985 ft (600 m) to the elevation of the dam plaza, El. 1,160 ft (354 m), and the cofferdam area; (2) erection of an initial construction village and facilities; and (3) excavation of a river diversion tunnel, which was started by Morrison-Knudsen International Company in the summer of 1958 and completed in December 1959.

Meanwhile detailed plans and specifications for the main dam, powerhouse, spillway and appurtenances were developed. The normal reservoir level was established at El. 1,147 ft (350 m), the reservoir below this level having a capacity of about 2,700,000 acre-ft. Live storage between the minimum level at El. 950 ft (290 m) and the normal level is 2,000,000 acre-ft.

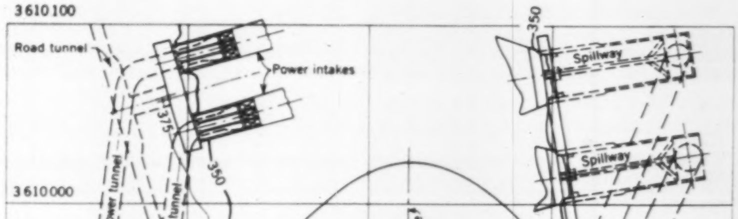

3610100
Road tunnel
Power intakes
Spillway
Spillway
3610000
Power tunnel
Power tunnel
375
350
Reference line
Plaza
Powerhouse
Transformer platform
Draft tube platform
3609900
Road tunnel
375
350
325
300
Future powerhouse
Control house
Dez River
275
250
225
200
175
3609800
261700
261800
261900
262000
262100
0 20 40 60 80
Scale in meters

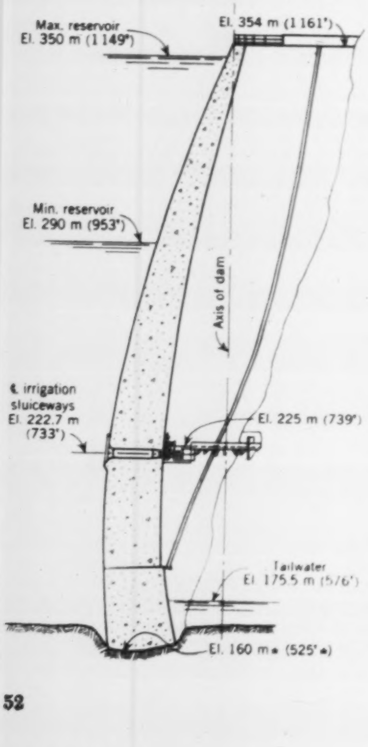
FIG. 2. In plan of the arch dam, contours are at intervals of 25 m, or 82 ft. Grid lines are spaced at 100 m, or 328 ft.

The planned structure is a double-curvature arch 630 ft high, with a crest length of 820 ft. Concrete thickness varies from 15 ft at the crest to 72 ft at the base. The dam structure consists of a base foundation course along the bottom and sides and a shell that carries the major part of the water load and is almost symmetrical about a slightly inclined centerline. The base course spreads the load from the shell over the foundation area. A perimetric joint separates shell from base. Concrete amounts to about 520,000 cu yd, which will be placed in some 720 monoliths. All vertical joints are provided with water stops near the upstream face. These joints will be grouted between grout stops near the upstream and downstream faces after the concrete has been cooled to near its final temperature. Model tests show that stress distribution during conditions of normal loading is remarkably uniform.

The dam will have three 108-in. sluiceways, each equipped with a 66-in. gate valve and a 60-in. Howell-Bunger valve, to maintain the desired low reservoir elevation during the flood season and to release water for irrigation and other purposes.

Two separate spillway gate structures, to be located on the east, or left, bank immediately upstream from the dam, will discharge into two lined tunnels of 46-ft and 41-ft diameter. These are about 1,300 ft long, and spill into the canyon some 800 ft downstream from the dam. The spillway outlets will be provided with suitable discharge structures to disperse the flow. Flow into each spillway tunnel will be controlled by motor-operated radial gates, with the spillway crest at El. 1,100 ft (335 m).

FIG. 3. Thin-arch Dez Dam, seen in section, has maximum width of 71 ft.



Max. reservoir El. 350 m (1 149')
El. 354 m (1 161')
Min. reservoir El. 290 m (953')
Axis of dam
℄ irrigation sluiceways El. 222.7 m (733')
El. 225 m (739')
Tailwater El. 175.5 m (576')
El. 160 m ± (525' ±)

The intake works will be on the right bank and, in the ultimate development, two concrete-lined tunnels, each branching into four penstock tunnels, will lead the water to the turbines. Flow of water in the branch tunnels will be controlled by butterfly valves.

Intakes for both present and future requirements will be built initially. However, downstream from the intake for the future powerhouse, only the main tunnel will be completed during the initial construction stage and this section of tunnel will remain partially unlined. For the present construction, the main tunnel and all four penstock tunnels leading to the first four units will be completed, including the butterfly shutoff valves located in the valve chamber near the powerhouse.

Power generating equipment will be located in an underground powerhouse, excavated in the rock, accessible via a 3-mile tunnel. This tunnel will wind down the right canyon wall from the top of the plateau to the top of the dam and thence to the powerhouse and the transformer deck immediately above the powerhouse. The initial powerhouse cavity will be 250 ft long, 58 ft wide and 117 ft high, sufficient for an erection bay and the installation of four units.

Provision is made for future extension of the powerhouse to contain a total of eight units. Initially, only two of the eight units will be installed. Each unit will consist of a turbine capable of producing 96,000 hp at near-best efficiency under an average net head of 500 ft. It will be direct-connected to a 72,222-kva, 0.9-power factor, three-phase, 50-cycle generator operating at a speed of 250 rpm. The units will be handled by a 240-ton overhead crane.

Three-phase, 84,000-kva, 13.2-230-kv transformers will be located on a transformer deck excavated at El. 738 ft (225 m) in the canyon wall above the powerhouse. From the transformers, high-tension lines will lead to an outdoor switchyard equipped with circuit breakers and a high-tension bus located on the plateau above the transformer deck at El. 1,905 ft (582 m).

Invitations for bids for the construction of the dam were issued, in June 1959, to 14 large construction firms, prequalified for the type of work required, and with participation on an international basis. A contract was placed with "Impredez," a joint venture of Italian firms that submitted the lowest bid. The venture consists of Imprese Italiane all' Estero (Impresit), Impresa Ing. Lodigiani and Impresa Umberto Girola. Impredez forces arrived at the dam site in mid-December 1959. In February 1960, a contract was placed with Brown Boveri Company for the construction of a 100-mile 230-kv transmission line from Dez to Ahwaz, where it ties in with a 132-kv line to Abadan.

During construction the river will be diverted through an unlined diversion tunnel of 50-ft diameter about 2,200 ft long. The crest of the upstream cofferdam will be at El. 703 ft (215 m) and the crest of the downstream cofferdam at El. 623 ft (190 m). The tunnel is estimated to be capable of a maximum discharge of 70,000 cfs, which is about equal to a flood flow of "once in ten years," which would occur only during the period, January 1 to March 15.

The dam was designed by Electroconsult, of Milan, Italy, on the basis of model tests carried out at the Istituto Sperimentale Modelli e Strutture (ISMES), in Bergamo, Italy. This work was supervised by a Board of Consultants consisting of A. A. Meyer, consultant to the Development and Resources Corporation, Dr. Carlo Semenza of SADE, and Prof. Guido Oberti of the University of Turin, Italy, and Director of ISMES.

Design of power facilities and waterways was done by the Development and Resources Corporation (DRC). Hydraulic design and model testing of the spillways was carried out at the Georgia Institute of Technology. Preparation of equipment specifications and construction specifications and drawings was done by DRC, which will supervise construction through its agency in Iran, the Khuzestan Development Service.

At present, in the spring of 1960, work is progressing on extensions of the construction camp and on the access tunnel from the top of the dam to the transformer platform and powerhouse. Contracts have been placed, under international bidding rules, for all major equipment. Final closure of the dam is scheduled for July 1962, and it is expected that the first unit will be in operation late in 1962.

While construction of the dam is proceeding, a pilot irrigation area of about 50,000 acres will be placed in operation to provide the necessary experience in methods and management to be used for the future larger area. Electric distribution networks in the cities of Khuzestan are being rehabilitated to receive and distribute the power that will be available.

why not more
WELDED STRUCTURES?

VAN RENSSELAER P. SAXE, F. ASCE, Consulting Engineer, Baltimore, Md.

Welding has now developed to the point where around 500,000,000 lb of arc welding rod is used by industry each year. Whole industries and processes have been built up through the development of welding. It has made possible the manufacture of many new articles of commerce which previously could not be made.

In cost, welding has proved to be competitive with, or more economical than, other jointing processes. This has been the case with road building equipment, canal lock gates, ships, missiles, tanks, boilers, heavy pressure piping, heavy machinery such as press brakes, and railroad equipment such as deisel locomotives, freight cars and passenger cars. Where the strength of the finished article is an important consideration, welding has practically replaced every other known process for joining parts. The use of welding by industry is so extensive that I doubt if anyone, even those most familiar with the subject, could name all its applications.

There are two fields however, in which welding is not extensively used. The first is the manufacture of machine tools and the second, the joining of parts in steel structures. The use of welding for structures is just getting started, even though extensive testing showed years ago that welding is the strongest and most economical way of joining structural steel members. Through years of laboratory testing, more is known about the behavior of such welded joints than about any other process for joining structural steel. In only two branches of the structural industry—the manufacture of bar joists and radio towers—is it practically universally used.

Steel fabricators have often been asked why they do not take more interest in welded structures. They point out that most of the structures they are concerned with are designed by engineers who do not design their structures for welded joints even though they will accept a factory-built welded bar joist. The fabricators have no choice but to submit estimates as required by the contract drawings. Structural fabricators claim that, in spite of many articles in engineering magazines showing the advantages of welding, engineers appear to doubt the strength and the savings that can be realized through welding. This applies to welded joints used both in continuous and in plastic types of design.

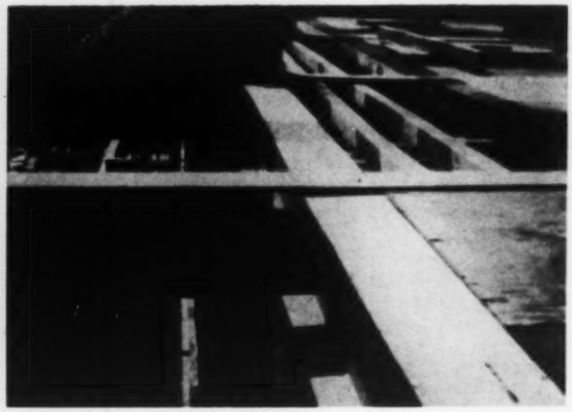
Personally I am not sure that structural engineers are as much to blame for this situation as some would have us believe. It must be remembered that these engineers are subject to a constant barrage of propaganda, consisting of whole truths and half truths, and they tend to stick to methods they have found to be satisfactory.

In the boiler industry welding has been adopted almost exclusively for all types of steam boilers. Still a large welded boiler is generally supported by a frame of riveted construction. This structural frame is made and supplied by the same company that made the welded boiler, as a part of the boiler contract.

Companies that make all kinds of electrical generator equipment, using welding to fabricate the units, will generally not use welding in constructing a new plant for themselves. They do not appear to realize that the same cost saving would apply to the building as to the generators.

New factories, not welded, are often constructed by manufacturers who make and sell welding equipment. It would have paid them to build a welded factory, not only because of the cost saving of at least 15 percent, but also because of the advertising value

Savings of 120 tons of steel and three months of construction time are attributed to the use of welded connections on this 14-story, 620,000-sq ft apartment house in Baltimore, Md.



Continuous type of design is achieved by passing top flanges of beams over top flanges of girders. Considerable savings result from this type of design.

in promoting sales of welding equipment.

In the tank industry welding has practically replaced all other methods of joining plates. Invariably the towers that support these tanks are not welded structures. Yet the owners know they realized a saving by purchasing welded tanks. They do not seem to be aware that a tower with welded connections would probably be much stronger and at least 10 percent more economical than one built by any other method.

Power plants containing 7,000 to 10,000 tons of structural steel are equipped with welded boilers, welded coal hoppers, welded heavy-pressure steam piping, and many other types of welded equipment. Considering the known savings realized through the use of welding for these units, one wonders why welding is not utilized to connect the steel parts of the structure itself. Here at least a 10-percent saving in steel tonnage could be realized. The price of the steel per ton would be the same and there would be a bonus in the form of increased structural strength.

Management in charge of plant construction seems not to realize that the savings welding yields in manufacturing processes are equally applicable to the structures that house such processes. For instance, in many one-story factory buildings with long spans between columns, in which trusses are commonly used, a 20-percent saving in material could be realized by using welding. Welded trusses can be purchased for the same erected tonnage price as for any other type of truss.

Take another type of factory or school roof in which the spans are not so long, and in which beams and girders are used. If this type of roof is designed with welded joints, it is not unusual to save 25 percent of the beam and girder tonnage. The welded steel in such a structure can be purchased for the same erected tonnage price as other types of steel.

At this point it might be well to give an illustration, one that actually applies to all types of continuity design. Two methods are in common use.

In the first method the size of the steel beam is based on the negative moment, $(wl^2)/12$, at the point of support. With this method the beam is oversized for its positive moment at the center.

The second is the "added plate method." This method has more even stress distribution although it requires more shop work. In this method the beam is designed for the positive moment at the center, $(wl^2)/16$, then flange plates are added at its ends to provide for the negative moment requirement of $(wl^2)/12$. New welding equipment recently put on the market, known as "manual submerged arc welding", has greatly reduced

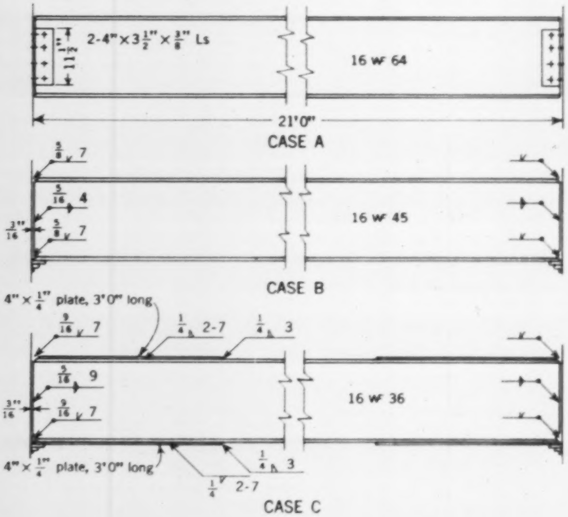
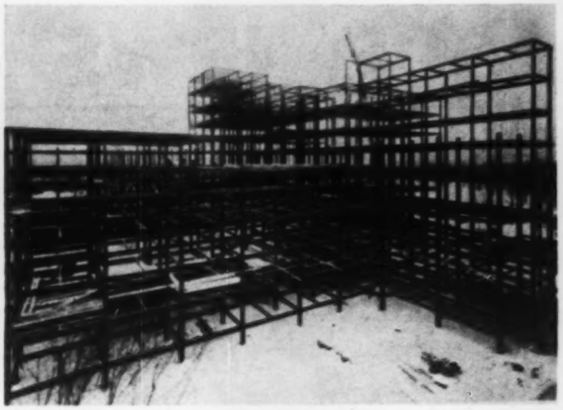


FIG. 1. Three 21-ft beams are compared. See Table I for savings in weight with various design criteria and connections.

TABLE I. Weights of material for three cases

Case	Weld Metal, lb: Shop	Weld Metal, lb: Field	Connection Steel: Seats, Angles, Plates, etc.	Beam Weight	Weight of Beam and Connections	Weight Saving Compared to Case A
A	....	....	56 lb (includes angles and rivets)	16 WF 64 21' 0" 1,344 lb	1,400 lb	....
B	0.76	4.80	2.4 lb (includes seat and clip support)	16 WF 45 21' 0" 945 lb	953 lb	457 lb (32.5%)
C	3.00	4.60	28 lb (includes weight of added plates)	16 WF 36 21' 0" 756 lb	792 lb	618 lb (43.7%)

Connection of beam to column for continuous moment design is seen here. Also shown are bar joists used in floor construction. Beam at right has added plates (see Case "C" in Table I).



This hospital designed with rivets would have required 2,317 tons of steel. Redesigned and built using welded connections, it required 1,988 tons, a saving of 329 tons of steel.

the cost of attaching plates to the beam flanges so that it now pays to use this method of design. Even though there is more shop welding and shop work, the steel tonnage is much less and the field cost of erection is lower because there is less tonnage to erect, and usually slightly less field welding.

An illustrative example

An example is given in three parts for a beam 21 ft 0 in. long and of the same load capacity in each case.

In Case A, the beam is designed for a simple moment, $(wl^2)/8$, for use with bolted or riveted connections.

In Case B, the beam is designed for continuous moment as required by $(wl^2)/12$ at its support, using welded connections.

In Case C, the beam is designed for continuous moment by the "added-plate" method. The beam size is determined by the requirement at the center for $(wl^2)/16$ and plates are added to the flanges at each end to meet the required negative moment value to $(wl^2)/12$ at the support, using welded connections.

In Table I it can be seen that welded connections can provide very large savings in the tonnage of structural steel.

It has been my experience that structural steel of Type A, erected, whether riveted or bolted, can be purchased for the same price per ton as Type B, welded. The saving in tonnage with Type B creates large dollar savings in the cost of a structure. Because of the extra shop work required, the erected price of Type C will average $25 per ton more than Types A or B. However the greatly reduced tonnage used in this type of design will bring the tonnage cost several percentage points lower than that even of Type B.

STEEL TYPE	ERECTED COST PER TON	ERECTED COST PER BEAM	SAVING COMPARED TO TYPE A
A	$280	$197.40	.....
B	280	133.42	32.5%
C	305	110.78	43.7%

These prices per ton, which are contract costs for a completely erected structure, include the cost of column fabrication and erection as part of the cost of a completely erected structure. There is normally little change in column weights regardless of which type of connection is used.

Welded plate girders, which require 15 to 20 percent less steel than similar riveted plate girders, are being successfully used on many bridges constructed under state and federal road programs. Many of the welded bridges are of outstanding design. Besides being very strong and rigid, they are not subject to corrosion at the joints as are other types of girders.

The preceding illustration also shows that considerable savings could be realized by the use of welded connections in so-called multiple-story buildings such as apartment houses, office buildings and hotels.

In the early days of welding, when there was very little information available on the subject, it is not strange that structural engineers avoided the use of welding on such structures. Today, the dollar savings through the use of welding are so large that they should not be neglected. In general it has been necessary for a structural engineer working on a welded design to dig up the needed information himself, with little assistance from outside welding experts. This situation is the reverse of that in the manufacturing shop, to which the welding companies send their most expert technicians to assist the shop personnel in their efforts to improve the product.

There are, however, signs of improvement in this situation. Some of the technical colleges have set up welding courses for the instruction of students. These younger men are now beginning to make their presence felt in the structural design field and seem to be designing most of the welded structures.

It would appear that many of the older structural engineers should consider having their young assistants learn the welding process so that welded work could be designed in their offices. The day is not far away when owners are going to ask for the savings that a welded structure can develop. Any engineer can assure himself of the quality of the field welding by having all the welded work examined by testing laboratories, most of which employ highly qualified welding inspectors.

Knowing engineers, since I am one myself, I am not too worried about the man who does not yet design welded structures. As engineers see more and more such structures built they will meet the challenge by learning how to design such structures themselves.

We engineers must learn how to use the welding process as advantageously as the equipment manufacturer does. I am sure we will get as full cooperation from the structural fabricating shops as the manufacturer gets in his processes. The fabricating shops know that use of welded connections is the only way to reduce the cost of steel structures.

ASCE NEWS

Reno Convention Spotlights Water

Reno's Mayor Bud Baker presents the key to the City to President Frank Marston at Reno's airport.

David B. Wellets, of the Los Angeles Department of Water Resources, addresses a water desalinization session.

Water—always a vital consideration in the arid West—was the featured subject at the Society's Summer Convention, held in Reno, Nev., June 20-24. More than half the 100 papers presented during the five-day technical program were devoted to the use and control of water. Dams as a means of control were studied in a number of interesting joint sessions with the U.S. Committee on Large Dams of the World Congress on Large Dams, which met during the Convention. The Sacramento Section and its Reno Branch were joint hosts to the Convention, which was attended by about 800.

Glenn Holcomb Nominee for President

The Board of Direction, meeting during Convention week, selected Glenn Holcomb, head of the civil engineering department at Oregon State College, as the official nominee for 1961 President of the Society (July issue, page 41). Election will be by letter ballot during the summer, with installation during the Annual Convention—to be held in Boston this year—October 10-14. Professor Holcomb has served ASCE as Director and Vice President.

The Board also selected four for the high distinction of honorary membership. They are Guy Atkinson, construction contractor of South San Francisco; S. C. Hollister, dean of the Cornell University College of Engineering; Frank Kerekes, dean of faculty at Michigan College of Mining and Technology; and Fred C. Scobey, consulting hydraulic engineer of Berkeley, Calif. Biographies and photos of the four will be in the October issue.

Governors Address Luncheons

A capacity audience at the Welcome Luncheon on the opening day of the Convention heard Governor Grant Sawyer of Nevada describe water as his state's first concern. Nevada's average annual precipitation is a scant 9 in. This requires wise and equitable distribution of the available water and sound planning for the future. The Governor said that a study of the hydrology of the Humboldt River Basin is under way to determine the physical and economic factors connected with upstream flood control and irrigation water storage. Another project—the Bureau of Reclamation's Washoe Project—provides for the construction of two dams on the tributaries of the Truckee River and one on the Carson River. The multipurpose project will also provide for power development and irrigation benefits.

The Governor also discussed the controversy over the use of the waters of the Colorado River, which flows along the southeastern edge of the state. He pointed out that the recent Special Master's report gives Nevada a fair share of Colorado River water.

Utah's civil engineer governor, George D. Clyde, F. ASCE, spoke on "The Engineer in Politics" at the General Membership Luncheon. He told an overflow audience that scientists and engineers must recognize their civic duty as thoroughly as they recognize their professional responsibilities, and take a proportionate part in politics and government affairs. He went on to say that with technically trained people at staff level only, and not at the policy-making level, serious danger threatens. His talk is briefed on page 45.

Prior to being elected to Utah's highest political office in 1957, Governor Clyde was director of the Utah Water and Power Board. Referring to his background, he said that he had found that training in engineering is invaluable to an understanding of the broad objectives of the water and sewer program in his state.

Awards Luncheon

Ralph A. Tudor, president of the Tudor Engineering Company, San Francisco, addressed the Awards Luncheon on Wednesday on the subject, "Partnership Power—Policy and Politics." Power partnerships, Mr. Tu-

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Apr 10-15 1961

Kachina of the sun says, "I'll be seeing you at the Phoenix Convention of ASCE in April 1961" to W. H. Wisely and President Marston. Behind the feathers are Elmer Maggi and Bob Choate, of the Phoenix Section.

dor explained, refer to some kind of working arrangement among the various public and private interests engaged in producing electrical energy for consumption in the United States. He said that the basic pattern is that the utilities, whether public or private, be encouraged to undertake the construction and ownership of power-generating facilities wherever possible. Leadership and impetus should come from the local echelon nearest the people to be served. The state and federal government should only assist and "not take over." Mr. Tudor said in conclusion that this partnership concept in power generation and distribution is a very fundamental matter to each citizen—it permits the residents of an area to determine their own destinies.

Presentation of the Society's newly established Professional Recognition Award to E. L. Chandler, who retired recently as Assistant Secretary of the Society, was a feature of the Awards Luncheon. The award—endowed by Edmund L. Friedman, former Director and Vice President—will be given annually to an ASCE member "who is judged to have contributed substantially to the status of the engineering profession." Mr. Chandler is the first recipient of the award.

Professional Practice in Surveying and Mapping

A highlight of the Convention was the symposium on the practice of photogrammetric surveying and mapping, which was jointly sponsored by the Highway Division, the Surveying and Mapping Division, and the Committee on Professional Practice.

In opening the session, Vice President Lawrence Elsener noted that it is realized that the statement of policy by ASCE, placing engineering surveying and mapping in a professional category, will bring about some difficult problems both for the Society and for those practicing in this professional category. However, he thinks that panel discussions and other presentations at meetings would help clarify the situation.

At this joint session L. L. Funk, of the California Division of Highways, stated that in setting up procedures to obtain photogrammetric mapping the following three thoughts should be kept in mind:

1. The method used should be compatible with the ASCE Code of Ethics.
2. The method used should be in accordance with the degree of professionalism earned by civil engineers engaged in this field.
3. The method used should allow government agencies to act in accord with their administrative and legal procedures.

In discussing the procurement of surveying and mapping services by the Corps of Engineers, Henderson E. McGee said that once it has been decided to contract for a particular surveying and mapping service then the next decision is to determine whether the procurement will be made by negotiation or by advertising for competitive bids.

When a surveying or mapping contract is of such a nature that the planning and execution of the work should be accomplished by or under the direction of professional engineers, the negotiation procedure is employed. When the work is such that the planning and execution can be performed by personnel having only a practical knowledge of the use of surveying instruments and techniques, advertising is normally employed.

When bids are taken, all bidders are required to furnish information as to the business and technical organization which the firm has available for the contemplated work. The right is reserved to reject any bid where an investigation of the organization of the bidder does not satisfy the contracting officer that the bidder is qualified to do the work.

"The Civil Engineer's Approach to Mapping Contracts" was presented by consulting engineer Clair A. Hill. He said that the engineer selected to perform the photogrammetric service should be selected on the same basis as for any other engineering service. After the selection has been made the engineer and the client should discuss the project in detail, including the purpose of the map, the future purpose, what control should be permanently monumented, the horizontal and vertical control accuracies, and all other features that go into making a professional job. The map will then serve not only immediate needs but also future needs in so far as possible.

Mr. Hill concluded by stating that he believed the continued use of the competitive bidding system for the obtaining of any engineering service, including photogrammetric services, can only bring unsatisfactory results and discredit on the profession.

All speakers agreed that unrestricted bidding is not a good procedure for obtaining surveying and mapping services. Furthermore it was agreed that additional educating and informing of individuals, engineering firms, and government agencies is necessary to facili-

At the General Business Meeting ASCE President Frank Marston (right) greets Glenn Holcomb, official nominee for President of the Society for the next year.

A group of highway experts presented a session devoted mainly to design featuers of highways through sparsely populated areas of the West. Shown, left to right, are: Edward Telford, R. H. Kenyon, M. F. Maloney, Rudolf Hess, Oscar T. Lyon, W. B. Ledbetter, Paul G. Martin, and B. F. McCollough.

tate transitional developments in mapping practice.

Construction—USCOLD Session

The many benefits to be derived from dams, with special reference to current Western projects, were discussed in stimulating joint sessions with the U.S. Committee on Large Dams. Trinity and Rocky Reach Dams were featured at the opening technical session—a joint program of the Construction Division and USCOLD.

Currently under construction by the U.S. Bureau of Reclamation is Trinity Dam in northern California. It provides the primary storage in a system of dams, reservoirs, power plants, tunnels and conduits designed to store and transfer surplus water from the Trinity River Basin for use in the water-deficient areas of California's Central Valley basin.

L. B. Ackerman, project construction engineer of the U.S. Bureau of Reclamation, described Trinity Dam as an earth and rockfill embankment, 2,440 ft long at the crest, and 2,620 ft in base width at the maximum section. It will contain about 30,000,000 cu yd of material. The height of 537 ft makes the dam, by a margin of about 25 ft, the highest earthfill yet attempted. Construction work at the dam site was started in 1956 when a contract was let for the excavation of a diversion tunnel for the river. A construction contract for almost $49 million was let in February 1957, with a period of just under five years allowed for completion of the work.

A progress report on the construction of the Rocky Reach Hydroelectric Project on the Columbia River in north central Washington, which will be one of the world's largest hydro plants on completion in 1964, was presented by W. N. Evans, resident manager of the Rocky Reach Contractors, and J. H. Boyd, project manager for the Stone and Webster Engineering Corp.

The project includes a 1,100-ft-long powerhouse which has a service bay at the south end and space for the installation of eleven hydraulic turbine-driven generators, seven of which are being installed at the present time. These units will have a total peak generating capacity of 775,000 kw when operating under a 93-ft gross head. Total peak generating capacity, when all the units are installed, will be 1,215,000 kw.

The Rocky Reach project is located on the Columbia River above the city of Wenatchee, where the Columbia flows in a tremendous canyon nearly a mile wide and 2,000 ft deep.

Still another project, the Upper American River Hydroelectric Project, was the subject of a paper presented to a combined session of the Power Division and USCOLD by C. H. Spencer, of the Sacramento Municipal Utility District, and D. S. Culver, of the Bechtel Corporation. Described as a multipurpose water conservation project, it will provide (1) electricity for the district; (2) beautiful mountain lakes and streams for recreation; (3) flood control measures for the area, and (4) stored water for later consumptive use and salinity control in the Sacramento Valley and Delta. The project includes the construction of some ten dams, their reservoirs and three powerhouses.

Flood Control

Few communities on watercourses in the U.S. are entirely free from the danger of floods, declared J. E. Goddard, chief of the Local Flood Relations Branch of the Tennessee Valley Authority. He told a joint session of the Hydraulics Division and the City Planning Division that flood control has heavy competition for the tax dollar. A national program must keep water away from man where he has already defied nature's laws and moved into a flood plain, and keep man away from water through judicious use of the police powers of the states and local communities. It is necessary, Mr. Goddard told the group, for engineers to analyze hydrologic data and prepare reports in such a manner that the laymen who make up city councils and planning commissions can understand the picture and be prepared to take necessary action. State and local governments must be active partners in a comprehensive plan for the success of any flood-damage abatement program.

Financing these flood control projects is of primary interest to all concerned—the federal, state, and local governments and the taxpayer. The method now used by federal agencies is the separable costs-remaining benefits method. The underlying principle of this method, as described by Amalio Gomez of the Corps of Engineers, is that all project functions should share equitably in the savings to be realized by the multiple-purpose development.

In the application of this method, project benefits for each function are first limited by the cheapest alternative cost of obtaining the same benefits. Then assigned to each function are all "separable costs," that is, costs that were incurred by virtue of adding each function to the project. The remaining costs are called "joint costs," or "residual costs," and are distributed among the various project functions in proportion to the benefits remaining after deducting each separable cost from each project benefit.

Water Desalinization

Two aspects of water desalinization were discussed at Irrigation and Drainage Division sessions. The first concerned the conversion of salt water to fresh water for areas lacking adequate fresh-water supplies for their population. At the second session, three papers were presented on requirements of water for irrigation purposes.

Samuel B. Morris, a veteran water resources engineer, told the group that the outlook for the economic use of fresh water from the sea is not favorable, at least in the three Pacific Coast states of California, Washington, and Oregon. According to Mr. Morris, it does not appear that fresh water from the sea will be able to compete economically with long aqueducts in the three

Pacific Coast states where total supplies of water are adequate and the amount of land facing the sea is very limited because of the coastal mountain ranges. "Certainly it will not compete with the one-and-three-quarter-billion-dollar California Feather River-Delta Diversion Project to be voted on November 8, 1960," Mr. Morris stated.

In registering this dissenting opinion about the future possibilities of using sea water for irrigation, Mr. Morris said that the demand for water is closely related to the price for which it can be delivered at the farmer's headgate. He noted that irrigation accounts for 90 percent of the consumptive use; the price at the farmer's headgate is about $1 to $10 per acre-ft, or $.30 to $3.07 per 1,000 gal. Only in limited areas of high-value crops can these prices be exceeded, he said. The recovery of fresh water from inland saline waters has the problem of disposal of the enriched brine wastes from fresh water recovery plants.

A unique combination of a nuclear reactor plant to be built in conjunction with a sea water conversion plant somewhere in California was reported. Presenting a paper on this federal sea water conversion plant planned for California, M. B. Andrew, of the Department of Water Resources of the State of California, said that the combination of the two plants seems to be a logical step toward advancing both technologies.

The plant is a multi-stage flash-type consisting of 42 stages in series contained in horizontal circular vessels. The evaporator system is designed to produce one mgd of potable water. It is one of five experimental water conversion plants authorized by Congress in 1958, three for sea water and two for brackish water.

The reactor plant to be built in conjunction with the California conversion plant was independently conceived by the Atomic Energy Commission as an experimental low-pressure, low-temperature process heat reactor, and was authorized by Congress with no designation as to location or application, Mr. Andrew stated.

Leon Bernstein, of the Agriculture Research Service, told another water desalinization session that although tolerance levels of plants to salinity can be stated for most of our important crop plants with respect to the concentration and in some cases composition of the root medium, the restrictions on irrigation water quality cannot be so precisely defined even with reference to a specific crop. The permeability of the soil, drainage, irrigation practices, amount and distribution of rainfall, and other factors may be so influential that the suitability of a given water for irrigation can hardly be appraised without reference to the conditions under which it will be used.

Raymond Hill, a consulting engineer, continued the session with a discussion of leaching requirements in irrigation. The accumulation of salts in the soil is one of the principal causes of failure of irrigation projects in the country. Restoration of the productivity of such lands depends first on the removal of the accumulated salts. This can be done by leaching—passing water through the saline soils. As the water percolates through the soil it picks up the salt and is then carried away by natural or artificial drainage methods. A salt balance must be maintained in the root zone of the irrigated land; the quantity of salt carried away in the percolate must be equal to the quantity of the same salt delivered on to the land in the irrigation water.

Four Highway Sessions

The Interstate Highway System, highways through highly agricultural areas, difficult construction conditions in the high Sierras, problems of community acceptance of highway locations—these and many allied subjects were up for discussion at four Highway Division sessions.

An important feature of the design policy governing the Interstate Highway System is that which relates to access. In fact, it is the controlled ac-

At the Welcome Luncheon, a capacity audience heard Nevada Governor Grant Sawyer discuss the industrial potential of his state. At left is Dean Howard B. Blodgett, General Co-Chairman for the Reno Convention.

President Frank Marston presents the Society's first Professional Recognition Award to E. L. Chandler, recently retired as Assistant Secretary after many years in ASCE service. He continues as ASCE Treasurer.

Francis G. Christian, member of the Flood Control Committee, Waterways and Harbors Division, presided at a session sponsored by that committee. Mr. Christian also headed the committee planning the Pacific Southwest Conference held on the last Convention day.

cess feature that distinguishes the interstate from the other federal-aid systems. In opening a symposium on the design features of the Interstate System through sparsely populated areas, M. F. Maloney, of the Bureau of Public Roads, stated that it is a balance between what is desirable and what is warranted that has motivated the design policy of the Bureau of Public Roads and the State Highway Departments in developing the Interstate System in rural areas.

The standards allow for intersections at grade for areas in the western part of the county where little-used crossroads, ranch entrances, and similar access requirements exist. This is done, however, only after an analysis has shown that the expenditure of public funds required to eliminate the crossing would be without adequate justification as a public need. Under this arrangement the state maintains the right to modify or eliminate the point of entry at a future date without further negotiation with the property owner.

Further problems encountered in establishing design policies on the interstate in rural areas were discussed by O. T. Lyon, district engineer for the Arizona Highway Department. He described the difficulty involved in establishing a traffic estimate for ranch or small mine-access roads with five or fewer cars per day. It is almost impossible to arrive at a factor which in every case is dependable. However, it is the policy in Arizona, because of the time required to construct the 1,200 miles of Interstate Highway, to complete interchanges and grade separations as encountered even though they are of little use for the present.

A roadway design feature used by Arizona on interstate construction in its rural areas is the full-thickness paving of the entire roadway width. It is felt that the savings in maintenance costs will offset the additional construction cost. The 3-in. asphaltic concrete course is placed in two layers. Two 12-ft lanes are seal coated with a 3/8-in. maximum cover material and emulsified asphalt. The inside 4-ft shoulder and the outside 10-ft emergency shoulder are flush coated with RC-3 asphalt to provide lane demarcation.

Highways through highly developed agricultural lands usually meet one obstacle—the ultimate cost of taking valuable farm land out of production. This includes the high costs of right of way to the state as well as the loss to the general public when such lands are taken off the tax rolls. R. H. Kenyon, of the Washington State Department of Highways, reported that the AASHO Benefit Analysis Policy shows that property must have a high value to justify relocation as we now estimate and appraise.

As an example, he said, the cost to the road user of 0.1 mile of added highway length—assuming 0 to 3 percent grades, average daily traffic of 20,000, and 48 mph running speed—is approximately $52,000 annually. When this is amortized at a 4 percent interest rate for highway bonds and over a period of 40 years the result is about $1,000,000. This merely means that an added length of highway to avoid expensive right of way will result in costs to the highway user which can easily justify the higher expenditures for right of way on a more direct route or be applied in offsetting an economic loss.

Much has been learned from the experiences of engineers in locating Highway 80 through Reno. The problems of community acceptance for this route were discussed by John E. Bawden, deputy state highway engineer for Nevada, before a session of the Highway Division. Two violently opposed public groups formed—one advocating a "downtown" location and the other insisting on a complete by-pass. Present plans indicate that a "downtown" route will be used but much opposition still exists.

As a result of the controversy, a

Following a general business meeting was a Conditions of Practice session at which a panel reported on the attitude of public agencies toward activity of public employees in professional societies. Participating were (left to right) Frank Weaver, Convention Co-Chairman R. Robinson Rowe, A. J. Peterka, Ray D. Spencer, and Moderator M. J. Shelton.

Governor George D. Clyde of Utah told a luncheon session that engineers should take a greater interest in politics. Listening to the Governor at the head table are Executive Secretary William H. Wisely, ASCE Director Wayne O'Harra, and Vice President Lawrence Elsener. The Governor himself is a civil engineer and member of the Society.

Many of the engineers attending the Convention enjoyed an inspection tour of highways in Nevada and California. The trip included Clear Creek Highway (U.S. Route 50). Shown on this route is a three-bench cut carved from the granite hillside. Material used in the fill raised the roadbed 152 ft from the base of the high fill.

Congressional investigation under the Hon. John A. Blatnik was held to determine whether Federal funds were being spent wisely in the Reno area. The committee concluded that Federal money was not being wasted. It stated in its report:

"The intensity of the controversy on the Reno-Sparks route selection is unfortunate evidence of what can happen if local bodies and the public have not received ample advance briefing. Notwithstanding that there has been technical compliance with the statutory requirements, in the opinion of the subcommittee, much of the Reno difficulty could have been avoided if more attention had been accorded by the state to the matter of public information."

A simple and reasonable approach has been established to the very difficult and complex problem of continuous concrete pavement design. In reporting on activities of the Highway Design Division of the Texas Highway Department, B. F. McCullough and W. B. Ledbetter reported that a pavement designed for concrete having a seven-day flexural strength range of 575 psi to 675 psi (as determined by center-point loading) and a thickness of 7.0 in. (rounded up from a 6.8-in. design thickness) with a longitudinal interior steel ratio of 0.5 percent (using hard grade steel) will be sufficient to withstand the greatest current loads.

It was further pointed out that:

1. Hard grade steel or welded wire fabric should be used for longitudinal steel in continuously reinforced concrete pavement. Longitudinal steel should be placed at the mid-depth of slab.
2. Concrete with a strength lower than that heretofore considered to be the minimum necessary should be used for continuous pavement in order that maximum utilization of the reinforcing steel might be realized.
3. Current specifications should be changed to provide a maximum as well as a minimum seven-day modulus of rupture with values depending upon local conditions.

Pollution

Air pollution—a subject of interest and irritation to the layman as well as the civil engineer—was the subject of a paper by R. T. Mapston, air pollution control engineer for the Richfield Oil Corp. In discussing the West Coast oil industry's effect on air pollution control, Mr. Mapston estimated that over $45,000,000 has been spent for air pollution control devices in the Los Angeles area refineries alone. As a result of this expenditure, the petroleum refineries in Los Angeles County have the lowest emissions to the atmosphere of any segment of our industry.

The control devices include vapor recovery systems or smokeless flares for hydrocarbons from relief valves; mechanical seals for pumps in gasoline or lighter service; and cyclone separators to keep catalyst dust emissions below the allowable 40 lb per hour. Coordinating the activities of the oil companies in the pollution problem is the Western Oil and Gas Association composed of the producers, refiners, and wholesale marketers of most of the petroleum and petroleum products in the six Western states. This organization makes recommendations on air pollution problems as well as supplying financial assistance for research projects in this field.

Sanitary-Construction Session

According to the Los Angeles Bureau of Sanitation, a number of encouraging results have been observed during the first three months of operation of the 12-ft concrete ocean outfall pipe recently completed for the city. Extending into the ocean for five miles and laid to depths of 200 ft, the pipe receives effluent through a pumping facility and is capable of discharging up to 600 mgd deep into Santa Monica Bay. There is little surface indication of the discharge.

Reporting on the completion of the overall job, Irvin Mendenhall stated that after three months of operation, the use of the old one-mile outfall is now being restricted to a flow of 100 mgd of activated sludge treated effluent. Coliform concentrations in the receiving waters have been nil, and consequently no disinfection by chlorine of the sewage discharged through the five-mile outfall has been necessary. The projected savings from eliminating chlorination come to about $300,000 per year.

Grouting

Use of a new chemical grout for making a watertight cutoff wall at Rocky Reach Hydroelectric Project was described in a paper by W. F. Swiger and J. H. Boyd of the Stone & Webster Engineering Corp. In this process, acrylimide monomer in water solution and a suitable catalyst are injected in a single process. Mixing is done at the top of the grout pipe. This is the first extensive use of chemical grouting on a major dam project in this country although such grouting has been done frequently in Europe. The most important principle in such work is assuring sequential grouting in which the more permeable strata are grouted first. Grouting is not a panacea, Mr. Swiger concluded. Used intelligently and with thorough supervision under conditions and soil characteristics to which it is adapted, chemical grouting can do a good job with safety, sometimes at significant savings.

Not All Work

Entertainment Reno Style, in addition to the many gaming attractions, included a Get-Acquainted Party at the

Hotel Mapes with a view of the Sierras that thrilled the Westerners as well as those from the East. Horseman's Park, close to the foothills of the Sierra Nevadas, was the scene of a rodeo and barbecue that will long be remembered as something different in Convention entertainment.

Ladies' Activities

The ladies, of course, accompanied their engineer husbands to these functions and, in addition, had an attractive program of their own. Especially enjoyed were the luncheon and fashion show featuring Early American and contemporary clothes. Many of the wives took advantage of special tours arranged for them and visited the historic ghost mining town, Virginia City, returning via Carson City, Nevada's capital.

No convention can ever be a success without months of planning and down-to-earth work. The great success of the Reno Convention was due to a team of dedicated Society members, headed by Dean Howard Blodgett, of the Reno Branch, and R. Robinson Rowe, of the Sacramento Section. Their committees worked diligently to insure the complete success of the meeting. Special credit is also due to Stewart Mitchell who headed the Program Committee.

Good Public Relations

Considerable publicity on the Convention was carried by the two Reno newspapers, the *Reno Gazette* and the *Nevada State Journal*, as well as the *Sacramento Bee*. The Associated Press and United Press International moved more than 500 words each day over their trunk wires, and the local radio and television stations carried reports of the technical program and other meeting events in their regular newscasts.

Highlight of the publicity, however, was a series of radio programs on station KOLO's "On the Spot" series. This is a 15-minute, interview-type program, directed mainly at women listeners. Its format is to present problems of the day for the attention of women. There were seven programs, running consecutively, and in each a prominent ASCE member was interviewed on a given subject. The ASCE "radio stars" and their subjects were: Paul Holland, city planning; Wayne O'Harra, highways; Frank Weaver, power; M. J. Shelton, education; Samuel Baxter, sanitation; P. H. McGauhey, water; and Benjamin Linsky, air pollution.

Executive Secretary W. H. Wisely also appeared on the local television station, KOLO-TV, in an interview regarding ASCE and the Convention.

Board of Direction Meets in Reno

The Board of Direction of ASCE met in connection with the Reno Convention to transact official business of the Society. Actions of general interest are briefed here:

Glenn Holcomb Nominee for President

The Board selected **Glenn Holcomb,** head of the civil engineering department at Oregon State College and former Society officer, **as official nominee for 1960-1961 President of ASCE.** A detailed biography of Professor Holcomb will appear in the October issue.

Honorary Members Selected

The **following outstanding engineers** were elected as **Honorary Members** of the Society: Guy Fredrick Atkinson, Solomon Cady Hollister, Frank Kerekes and Fred C. Scobey.

Reynolds Made Assistant Secretary

Don P. Reynolds was made Assistant Secretary of the Society to fill the vacancy created by the retirement of E. Lawrence Chandler. With a view toward further strengthening the administrative structure of the staff, the Board recommended that at the earliest opportunity amendment of the Constitution be considered to permit the appointment of two or more Assistant Secretaries.

ASCE Prize Winners Confirmed

The Board confirmed the recommendations of the **ASCE Committee on Prizes** for 1960 prizes and awards. The recipients were listed in the July issue (page 41).

Work with Consulting Engineers

Participation by ASCE in a joint committee with the **American Institute of Consulting Engineers** and the **Consulting Engineers Council** was authorized. This committee will centralize policies and actions relating to private practice of engineering and will report to the Board of Direction through the Executive Committee of the Department of Conditions of Practice.

ESPS Supported

The **Engineering Societies Personnel Service,** sponsored by the Founder Societies, currently is operating at a loss in providing employment service to members of the Engineering Societies at a lower fee than is charged by commercial agencies. There have been proposals to curtail its services. The Board of Direction voted that ASCE favors continuance of the existing offices of ESPS in San Francisco, Chicago, and New York; that the present operations of ESPS be so adjusted as to bring expenditures within income; and that ASCE be recorded as favoring the continuance of the service even though reasonable subsidy may be required in the future.

Districts and Zones

The **Committee on Districts and Zones** submitted a preliminary report for revision of ASCE group boundaries to more equitably distribute the work load among the Directors and to establish areas of optimum mutuality of interest and facilities for travel. In so far as possible, division of a state between Districts has been avoided. There are a number of boundaries still under discussion. The final report will be presented to the Board of Direction prior to the Boston Convention.

Unprofessional Conduct Censured

The Executive Secretary was directed to send appropriate letters to ASCE members of engineering firms who have permitted their names to appear in **objectionable advertisements.** Similar letters are to be sent to the companies placing such advertising. The Executive Secretary was also directed to transmit letters of censure and concern to several members of ASCE for specified unprofessional actions. Additional information on this is to appear in a later issue of CIVIL ENGINEERING.

Engineers in Public Practice

On recommendation of the **Committee on Engineers in Public Practice,** the Board voted to endorse the principles of the National Society of Professional Engineers' five-point proposal to revise the Federal Classification Act to promote the recruitment and retention in government service of an adequate number of qualified engineers and scientists. Briefly, agency heads should have more authority in setting and adjusting pay rates; in high-demand categories higher salaries should be permissible; a procedure should be established for adjusting salaries as non-governmental rates change; outstanding ability and performance should be recognized; and the artificial distinction between the "super-grades" should be eliminated. Executive Secretary Wisely is to develop an appropriate statement for transmittal to the House Committee on Post Office and Civil Service.

Surveying and Mapping

The Board approved a stepped-up campaign to acquaint users of surveying and mapping services with the ASCE recognition of Land Surveying, Engineering Surveying, Geodetic Surveying and Cartographic Surveying as professional work. It is hoped that by education and persuasion contracts for such services as require engineering judgment will be negotiated rather than obtained on a bid basis.

The letter (in ASCE News, p. 112) which Executive Secretary Wisely has been sending to procurement agencies that have asked for bids for such services, is to be given wider distribution to acquaint as many as possible with the professional status of surveying and mapping.

Local Sections

Formation of a **District 16 Council** (to consist of Colorado, Kansas, Nebraska, Wyoming, most of Iowa and part of Missouri) was authorized.

Formation of a **Vermont Section,** breaking away from the Maine Section, was approved.

Formation of a **Youngstown Branch** of the Cleveland Section and of a **North Dakota Branch** of the Northwestern Section was authorized, along with abolition of the St. Lawrence Branch of the Syracuse section.

The Board of Directors endorsed a report of the Committee on Local Sections, advocating: (1) Formation of more Branches, (2) smaller, and more, Local Section conferences, (3) continued visits by Board members and headquarter staff to Local Sections, and (4) expanded recruiting of possible members.

Manual of Ethics

The Board briefly considered an interim report on the **Manual of Ethics** and referred it to committees for further study. It is its intent that the interim report be presented to the Board at the Annual Convention in October.

Student Clubs

In another important action, the Board gave **permission to organize ASCE student clubs at schools** that do not yet have a civil engineering course accredited by the Engineers Council for Professional Development but whose graduates are eligible for engineer-in-training certificates. A minimum membership of twelve students is required: such students may subscribe to CIVIL ENGINEERING at the student rate of $2.50 per annum. Handbooks and general material for Student Chapters will be available. However, Student Clubs do not receive an allotment of Society funds as do Student Chapters, there is no reimbursement to advisers for travel to Faculty Adviser conferences and the ASCE entrance fee is not waived as it is for members of ASCE Student Chapters.

Convention Schedule

The Board reviewed the Convention dates and locations and voted to authorize a Convention at Kansas City, Mo., in October 1965 and in Philadelphia in October 1966. The scheduled Conventions follow:

Oct. 10-14, 1960,	Boston, Mass
April 10-14, 1961,	Phoenix, Ariz.
Oct. 16-20, 1961,	New York
Feb. 19-23, 1962,	Houston, Tex.
May 14-18, 1962,	Omaha, Neb.
Oct. 8-12, 1962,	Detroit, Mich.
Feb. 25-March 1, 1963,	Atlanta, Ga.
May 20-24, 1963,	Milwaukee, Wis.
Oct. 7-11, 1963,	San Francisco
Feb. or March, 1964,	Cincinnati
May 11-15, 1964,	Salt Lake City
Oct. 19-23, 1964,	New York
Oct., 1965,	Kansas City, Mo.
Oct. 1966,	Philadelphia

United Engineering Center

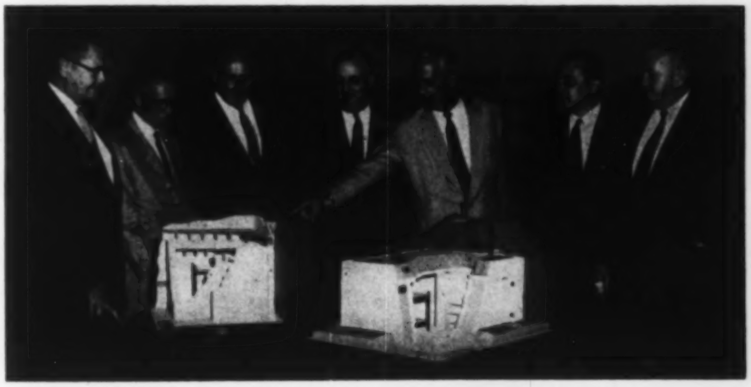
President Marston asked each Director to report on the status of the **fund-raising drive in his District,** noting that only a few thousand dollars was needed to complete the ASCE quota. Only in five Local Sections was it indicated that future prospects were doubtful or poor. Especially good activity was reported in the Los Angeles, Pittsburgh, Cleveland, Wyoming, National Capital, Texas, and Louisiana Sections.

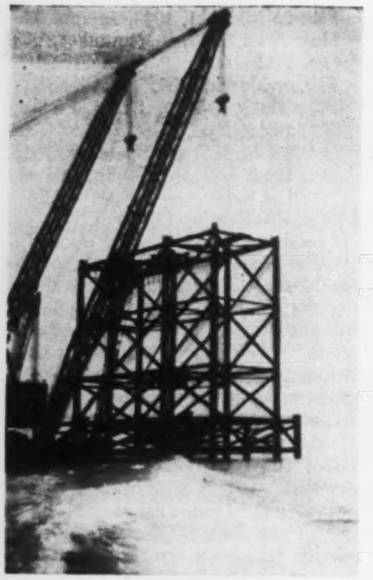
President Marston asked every member of the Board to assume responsibility for seeing that at least $1,000 in new pledges is secured from each District at the earliest possible time so the ASCE quota can be met in this fiscal year. A telegram was sent to the president of each Local Section that had not yet made its quota requesting information on status and prospects for the campaign in the Section.

(More ASCE News on p. 102)

ASCE Committee on Civil Defense Meets

Civil defense responsibilities and the interests of civil engineers were studied at the first meeting of the ASCE Coordinating Committee on Civil Defense, held recently at the headquarters of the Office of Civil Defense. Recommendations have been made to the Technical Divisions and Local Sections. Pictured, left to right, are Arthur D. Caster, chairman of the Coordinating Committee; Richard W. Dennis; Francis A. Carboine; J. Cal Callahan; Arthur D. Morrell, deputy director of OCD research and host to the meeting; Don P. Reynolds, recently named Assistant Secretary of ASCE; and Kenneth Markwell, director of the Engineering Division of OCD and adviser to the ASCE Committee. Photo was taken at the OCD offices in Battle Creek, Mich.





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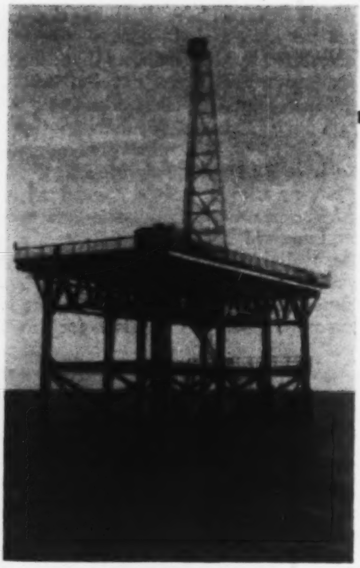

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1. **Drilling platform is suspended by huge derrick barge and is about to be set in position in the Gulf of Mexico.**

2. **Bilby tower is in position over a U.S.G.S. monument. This is one of the control stations established in 1955 by U.S.G.S. on thirty offshore platforms.**

3. **Mobile drilling barges and the platforms that support the rigs require accurate surveying, often done under extremely adverse conditions.**

4. **Boats like this one are equipped with electronic surveying equipment and are used extensively in offshore surveying work.**

4

Offshore surveying includes everything from very rough hydrographic surveys to precise triangulation. Equipment ranges from the sextant to the most modern electronic devices. The area of work extends from the marshes along the coast to the open seas eighty miles from land. An offshore surveyor must feel at home while wading in a marsh in search of a control survey monument, turning angles from the top of a small platform 100 ft in the air at midnight, riding 10-ft swells in the open sea, searching the archives for an ancient Spanish map, or making tedious computations in an air-conditioned office.

Surveys of a number of different types are required when an oil company is operating in offshore waters.

The geophysical work must be located so that the work can be correlated and the position and outline of offshore geological structures defined. The requirements for geophysical surveying are not as accurate as those for many other types but the methods should be rapid so that the equipment, which is expensive, can be utilized as much as possible.

Position located three times

The mobile drilling barges and the platforms that support the drilling rigs must be located. The surveying done for a platform location must be reasonably accurate. The ultimate location of a drilling platform usually requires the location of the same position three times: (1) the planned position is located so that the water depth can be determined, (2) a coring barge is positioned so that foundation tests can be made, and (3) several months later the drilling platform itself is placed.

After production has been obtained from several wells it is usually necessary to lay a pipeline to a convenient storage terminal. The pipeline must be located so that it is within a specified right-of-way and so that future operations can be planned without interfering with it. In the course of developing a field, hydrographic surveys are required so that production installations can be planned. In shallow areas,

OFFSHORE SURVEYING

means working under pressure

GEORGE E. JONES, Survey Engineering Supervisor, The California Company, New Orleans, La.

access canals must be located and staked to guide dredging operations.

Leasing of offshore waters adjacent to the Louisiana coast really began in 1946 and 1947. Before that time the State of Louisiana had issued a number of leases covering bays and coves but very few deep-water leases. With the start of the accelerated leasing program, offshore leases had to be described and located according to a definite pattern.

A uniform system of blocks of 5,000 acres each—in most cases, squares 14,750 ft on a side—was projected on a map. The blocks were designated by area and number and a coordinate was calculated for each boundary. Leases were issued on whole blocks or parts of a block.

When the Federal Government began leasing activities in the Gulf of Mexico, the block designations and boundaries established by the State of Louisiana were retained. With the development of methods of drilling in water 200 ft deep, the system of blocks had to be extended farther from shore. The same system of designating and describing the blocks was used.

The coordinates used in describing the boundaries of the offshore tracts are based on the Louisiana Coordinate System, which is a Lambert conformal projection. This system was developed by the U. S. Coast and Geodetic Survey; similar systems have been developed for each state. This system has a zero position south and west of the State of Louisiana and every point in the system is described as being so many feet north and so many feet east of the zero point. The distance between any two points is calculated by taking the difference in the coordinates and using the appropriate trigonometric formula.

Although the lease boundaries in the Gulf of Mexico are very accurately and definitely described, there is no line on the water or posts on the corners to define the actual boundary. As in most descriptions it is necessary to begin the location of a tract from some well established point. In the early stages of offshore operations the nearest permanent beginning points were the horizontal control stations along the coast which had been established by the U. S. Coast and Geodetic Survey. The positions of these stations are described in accordance with the respective state grid systems. Therefore in Louisiana the relation between any control station and an offshore lease corner can be calculated.

The U. S. Coast and Geodetic Survey has established control survey stations throughout the United States to provide accurate starting points for surveys, a means of coordinating surveys, and a check on survey accuracy. Along the coast of the Gulf of Mexico control stations were first established about 1850. Since that time the Survey has remonumented and supplemented the original surveys many times so that there now is a control station about every 15 miles along the coast. The density of control stations is much greater at the mouths of rivers and in thickly populated areas.

During the spring of 1955 the U. S. Coast and Geodetic Survey established new horizontal control stations along the coast of Louisiana and located monuments on 30 offshore platforms. This program was instigated by the oil companies and partially financed by them; 15 oil companies paid $5,000 each.

In addition, most of the oil companies established their own survey control along the coast and out on the platforms. In a number of cases the survey began at the nearest U.S. Coast and Geodetic Survey monument some 10 to 20 miles inland and was extended to the coast. There are now survey towers all along the coast that have been erected by the various companies. Some of the survey control data have been exchanged between companies and most of the towers have been used by several companies. Much of the survey control work has been duplicated; in active areas, as many as six different companies have their own survey control.

Since it is impossible to measure long distances over water accurately by chaining or using a wire line, triangulation is used for most operations in the Gulf. The composition of an offshore surveying crew will vary according to the job, but it will normally include a party chief, two or more instrumentmen, and two or more helpers. Theodolites are used for most horizontal control surveys. Transits or theodolites are commonly used for geophysical locations, positioning of drilling barges, locating pipelines, and making hydrographic surveys. Signal lights, mirrors, and wood or cloth targets are used for sighting.

The offshore surveyor must use buoys to mark many of his points. In the Gulf, buoys vary from a small piece of cork to huge drums with lights and radar reflectors. Anchors for these buoys vary from sash weights, old drill bits, and concrete blocks to conventional anchors that may weigh as much as 3,000 lb. Certain U.S. Coast Guard specifications regarding lights and coloring must be satisfied when a buoy is used to mark a position in the Gulf for a considerable length of time.

One of the primary requirements of an offshore surveying crew is good communication. Hand signals, generally used by land surveyors, cannot be used because of the distances involved. Blinking signal lights using the Morse code are employed to a limited extent but radios offer the best method. Small walkie-talkie sets are adequate up to a distance of about 15 miles and are very useful for locating development well structures in an established field. For distances beyond 15 miles the usual boat radios or large pack sets are used.

Visual surveying offshore is limited by two things—the earth's curvature and the weather. Since there are no hills or bluffs along the Louisiana coast that are high enough to increase visibility, the surveyor is dependent on towers. Thirty-seven miles is the maximum distance that can be observed from towers about 200 ft above the water (the top of an offshore rig is about that high). A location can be checked roughly at a distance of more than 37 miles by observing parachute flares fired some 1,500 ft up into the air.

Weather conditions frequently limit visibility. In January and February, fog may prevent visual observations several hours each day. Crystalization of salt particles in the air prevents long sights at times. On occasion haze blocks visual observations of more than 15 miles.

Offshore surveying costs considerably more than land surveying, primarily because of the transportation problem. Sea-going crew boats cost about $240 a day. The total cost of an offshore surveying crew is normally about $500 a day. The visual surveying cost of locating an exploratory well some distance from existing control stations is about $5,000.

Electronic surveying

Electronic surveying utilizes instruments that measure the travel time of radio waves or the phase difference between radio waves from two transmitters. Several types of equipment are in common use today—radar, sonic, Shoran, Raydist, Lorac, and the Tellurometer.

Shortly after World War II the oil companies extended their search for oil in the Gulf of Mexico beyond sight of land. This created an immediate need for something more than visual surveying. Several electronic positioning devices, developed during the war for mapping control, precision bombing, and aircraft spotting, were adapted for use by the petroleum industry.

During the first few years the most widely used methods were radar, sonic and Shoran, all of which measure the distance between objects by the time required for a radio wave to travel between them. The radar method is based on the measurement of the time required for a radio pulse to travel from a ship to some object, be reflected and return to the ship. The bearing and distance to several objects of known position can be determined and the position of the vessel computed. The sonic method utilizes "sonobuoys" which contain a hydrophone, an amplifier, and a radio transmitter. The hydrophones on two or more "sonobuoys" at known positions pick up sound vibrations from the water and transmit them to the vessel. Knowing the velocity of sound in water and the velocity of radio waves in the atmosphere, the distance between the source of the sound vibration and the sonobuoy can be calculated.

The Shoran method is similar to the radar method in that a radio pulse is transmitted from the vessel, but instead of being reflected by an object, the radio pulse activates a beacon at a known position which transmits another radio pulse back to the vessel. The elapsed time for the travel of the radio pulse is converted into distance, from two or more known points, giving the position of the vessel.

Shoran was used much more off the coast of Louisiana than the other two methods because it is more accurate. The equipment generally has an accuracy of plus or minus 75 ft on any one range. All three methods are limited to line of sight; therefore, the range is limited to about 25 miles when 100-ft towers are used.

As the exploration work moved farther offshore, electronic methods with a greater range became necessary. These utilize the difference in phase between radio waves transmitted from two stations at known points. Raydist, Lorac, and Decca are trade names for methods that utilize the phase difference principle; Raydist and Lorac are used in the Gulf of Mexico. If the points of zero phase difference between two transmitters are plotted on a map, they form a series of hyperbolas. When two pairs of transmitters are used, two hyperbolic families are shown on the map with intersecting lines. The indicating equipment on the vessel receives the signals from the two pairs of transmitters and determines its line of position in each family of hyperbolas. The intersection of the two lines of position determines the position of the vessel.

In Lorac and Raydist portable transmitters are often used. However, the need for electronic surveying along the Louisiana Coast led both the Lorac and Raydist companies to construct about twenty permanent radio towers. Each was locatel by a visual survey, and Louisiana coordinates were computed for each transmitter.

The advantages of the Raydist and Lorac systems are that positions can be ascertained at any distance from the shore as far as 150 miles; cloudy or hazy weather does not interfere with operation; any number of ships can use the system at any one time; and the determination of positions is relatively rapid.

One of the most recent electronic devices used in the Gulf of Mexico is the Tellurometer. The master unit transmits a series of radio pulses which are received by a remote unit and retransmitted. The time required by the microwaves to make the round trip is converted to a distance measurement. The accuracy obtained by careful operation is much better than that of the other electronic systems. Positions can be determined by Tellurometer measurement of the three sides of a triangle or by measuring distances with the Tellurometer and angles with a transit or theodolite.

The Tellurometer can be used in cloudy, foggy weather; the equipment is easily carried and the accuracy is remarkable. The system is limited to line-of-sight measurements; therefore the range is limited to about 25 miles when 100-ft towers are used on both ends of a line. Although the equipment can be used on a boat, its operation is severely hampered by wave action and the movement of the vessel.

Assuming favorable weather, the time required for a specific location is one to five days depending on the distance from shore and the number of location runs made. If the electronic equipment must be placed on a ship, an additional two days are required. The normal cost of Lorac or Raydist for a drilling-barge location is about $1,000 a day, or about $3,000 to $5,000 per location if no time is lost because of bad weather.

Typical offshore location

To correlate the various phases of offshore surveying, let us go through the steps involved in locating a mobile drilling barge about 20 miles from shore, assuming that there are no drilling platforms within 20 miles.

The description of the proposed location may be in terms of coordinates, dimensions from a lease or offshore block corner, shot point, or a course and distance from a horizontal control monument. The grid coordinates of the location are calculated. The lease on which the barge is to be located is checked and the positions of the boundaries are determined. All the available maps of the area are examined to ascertain the depth of water at the location, the proximity of other platforms, lights, or other objects, whether the location is in or near a restricted area such as a navigation channel, fairway, or bombing range. The horizontal control data in the area are examined to see whether the control monuments are sufficient for checking the location or whether additional triangulation work must be done.

Actual planning of the location operation is then undertaken. The date and estimated time of arrival of the drilling barge at the location is obtained from the production division; the type of barge is ascertained so that the surveying operations can be coordinated with its actual placement. The electronic surveying company is contacted so that they can plan to set the location buoy. The visual surveying crew is organized; their equipment is assembled; boats for their transportation are hired; and radios with adequate frequency and range are obtained.

About four days before the mobile drilling barge is to be placed, the Raydist or Lorac survey boat leaves its shore base, starting so as to arrive at the nearest calibration point about sunrise. The atmospheric conditions accompanying sunrise and sunset affect the radio waves so that operations during those periods are avoided if possible. Shortly after sunrise the boat proceeds to the proposed location. The operator of the electronic surveying equipment counts the lanes of position as they are crossed and directs the boat to the correct position, where a small marker buoy is dropped overboard and stabilized. The survey boat stops long enough for the operator of the electronic equipment to note the exact reading. The boat then returns to the calibration point and the electronic equipment is checked again. Readings at the calibration point and at the buoy location are then radioed to the shore base so that the actual position of the buoy can be computed. The whole operation usually requires two days.

A stand-by boat accompanies the Raydist or Lorac survey boat to the location and places a large buoy near the marker buoy dropped by the electronic surveyors. The stand-by boat then anchors near the location and waits for the mobile drilling barge to arrive. The purpose of the stand-by boat is twofold—it acts as a guide so that the drilling barge can proceed to the location without loss of time, and it provides a check on any movement of the location buoy.

The visual surveying crews leave their shore base in two boats about a day later than the electronic survey boats. One boat proceeds to the location and places a man on the stand-by boat, then moves on to the nearest survey control tower or platform. The other survey crew goes to a second survey control tower or platform. The whole operation is timed so that the surveyors arrive at the observation points shortly before dark. The theodolites and signal lights are placed in position and the radio communication is checked between the two survey crews and the surveyor at the location buoy.

Shortly after dark the position of the location is checked by observing a light on the boat mast or parachute flares fired from the stand-by boat. At a distance of 20 miles the theodolite and the point being observed must be at least 57 ft above the water. If the top of the boat mast is only 40 ft above the water, the theodolite must be 80 ft above the water. The surveyors check the location from a third observation point if time permits.

When the drilling barge arrives at the location and begins to drop its anchors, the surveyors sight on the derrick and direct the barge into the correct position. This is a precaution against loss of time caused by the sinking or moving of the location buoy by the barge. The cost of a mobile drilling barge, supply barges, and attendant tugs on an off-shore job is approximately $10,000 a day. Therefore it is essential that no time be lost replacing a buoy that has been moved. The surveyors continue to observe the drilling barge until it is stabilized in contact with the bottom of the Gulf.

Offshore crew boat with surveyors approaches drilling platform.

The position of the drilling rig is accurately located by visual observations from two or more survey control points. This final tie-in gives an accurate position that can be used for additional survey control or by the geologist to correlate information obtained from the well.

Weather conditions are important in offshore surveying. Rough seas or fog may delay a location as much as a week. Since many offshore platforms are at least a 10-hour boat run from the nearest protected harbor, accurate advance weather information is essential. Most oil companies retain weather forecasting services to predict weather, wind velocity, and wave heights.

Visual surveying is used almost exclusively for locating development platforms in an established field and for locating exploratory wells that are 15 miles or less from horizontal control stations. Visual surveying may be used to check the location of wells where the sights are more than 15 miles. For locating exploratory wells that are more than 15 miles from horizontal control stations, electronic methods are used. Greater tolerances should be allowed between locations and critical lease boundaries when electronic methods are used.

The surveyor who is locating drilling barges or platforms in the Gulf of Mexico works under more pressure than the surveyor doing work on land. Several factors are responsible:

1. The cost of off-shore operations and the resulting loss of money if a well is incorrectly located place a tremendous responsibility on the surveyor.
2. The surveyor must organize his work so that there are no delays in the construction work or in the moving of a barge. Since, as has been mentioned, the equipment involved in a normal drilling-barge move costs about $10,000 a day, a delay of one hour while the surveyor checks the observed angles or reviews his calculations costs about $400.
3. Unlike the situation in land surveying, there are no fences, roads, houses, creeks, or accommodating land owners that can be used as a rough check to determine whether the location is properly positioned on the lease. The surveyor is entirely dependent on the accuracy of the observed angles and the correctness of his calculations.

(This article was originally presented as a paper at the ASCE New Orleans Convention, before a Surveying and Mapping Division Session.)

Storm drainage and gas burning at a refuse disposal site

WALTER L. DUNN, M. ASCE, Associate Professor

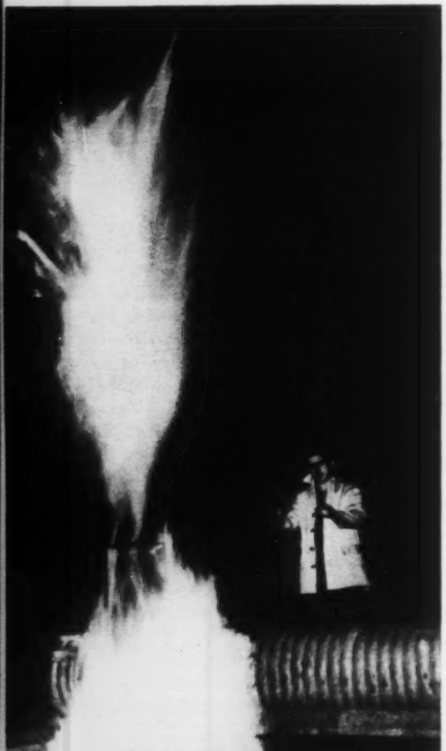
Department of General Engineering, University of Washington, Seattle, Wash.

Swamp land at the edge of Lake Washington, and adjacent to the campus of the University of Washington, is loaned by the University to the City of Seattle as a refuse disposal site. When filled, it is reclaimed by the University. In 1958, another 25 acres adjacent to the campus, which had been filled with refuse by the city, was surfaced for parking. Large seepage pits were constructed on the finished fill to determine whether storm water could be disposed of by this method. However, heavy rains have frequently flooded the area and the pits have not proved very satisfactory.

In 1959, when 10 more acres were surfaced for parking, another method of storm-water disposal was tried. Large French-type drains were "built in" as the refuse was placed. Waste lumber from razed homes and buildings was used to construct French drains about 20 ft wide, 10 ft deep, and several hundred feet long. The drains carry the storm water underground to the adjoining swamp. The upper ends of the underdrains terminate in a 20-ft length of 24-in. culvert which is covered with earth. An inlet and catch basin is constructed over the upper end of the culvert, as shown in Fig. 1. This system of French drains has provided an economical means of storm-water disposal for more than a year.

Disposal of water within the refuse fill has several disadvantages, one of which is the foul odors released. Leaching of organic materials occurs as the water passes through the fill. However, a sampling program carried out in Union Bay and adjacent Lake Washington for several years has indicated that no additional pollution has been getting into the lake. The great quantities of peat and growing vegetation undoubtedly provide a buffer between the refuse fill and the lake.

Domestic garbage and rubbish disposed of at the site is placed in cells and covered with earth daily, so that



Controlled burning of waste gas at Union Bay, Seattle, refuse site oxidizes methane and destroys odors. Photo courtesy Post Intelligencer, Seattle, Wash., by Stuart B. Herz.

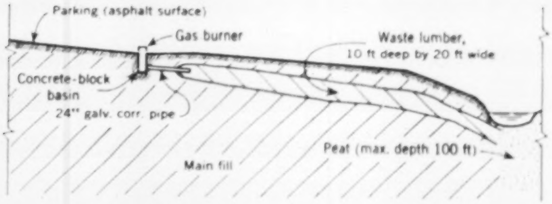


FIG. 1. Schematic profile shows how French storm drains are placed for gas collection at the Union Bay refuse site. Main fill consists of domestic rubbish and garbage and of public rubbish. Domestic garbage and rubbish is placed in 6-ft layers and covered daily with one foot of earth; public rubbish is compacted but covered only when placed as uppermost fill.

A French drain of waste lumber is being "built in" to the refuse fill. Photo courtesy University of Washington, by Whitie Martin.

the storm water does not directly leach through this somewhat putrescible refuse. However some water does get into the refuse cells since they are placed under and beside the French drains, with only a foot or two of earth cover between.

Working in reverse, the large underdrains also collect gas caused by decomposition of putrescible matter which escapes through the culvert and inlet. This gas is about 60 percent methane and 40 percent carbon dioxide and nitrogen, with traces of odor-causing compounds. Controlled burning at the specially constructed inlets oxidizes the methane and destroys the foul odors of the trace compounds. An accompanying photo shows the gas burning at one of these inlets. Previously this waste gas was burned on a smaller scale, as reported by the writer in CIVIL ENGINEERING for November 1957 (vol. p. 790). Although the inlets could be water-trapped, it is not desirable to do so. The gas pressure would build up and the gas would eventually escape through cracks in the surface.

Three of the combination gas burners and French drains burn nearly continuously during wet weather. Other French drains are being constructed as the fill progresses, and one of these is shown in an accompanying photo.

It is not known how long the gas will continue to be produced, but the regular addition of storm water should expedite decomposition. It is hoped that the gas and accompanying odors may cease after a few years. Silt accumulation and continuous settlement of the fill will reduce the capacity of the drains, but it is expected that they will continue to remove storm water for several years. After that, reduced settlement may permit economical construction of a storm-sewer system.

TIDAL BASIN AND LOCK FOR A KOREAN PORT

DANIEL A. RICHARDS, F. ASCE, Colonel, Corps of Engineers, U.S. Army

District Engineer, Far East District, Seoul, Korea

Korea's Port of Inchon has an exceptionally high tidal range, which is exceeded at only a few locations in the world, such as the Bay of Fundy and Cook Inlet. Inchon's daily tidal range varies with the lunar phases from 9 to 30 ft and the annual range is as great as 33 ft.

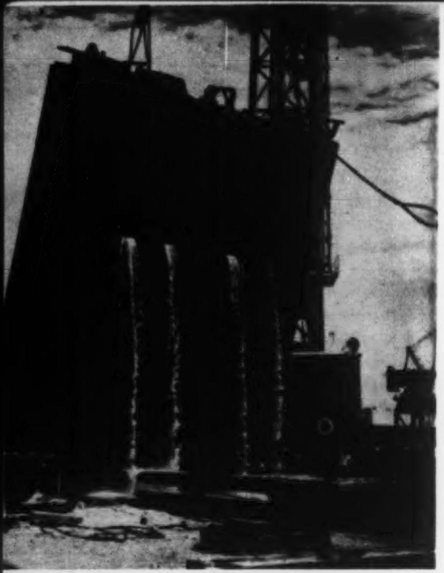
Since Inchon is the second largest port of South Korea, these conditions have been a hindrance to economic development. At low tide great areas of the harbor are exposed as mud flats, preventing dockside loading and unloading and requiring lightering from anchorages in the main channel. Even lightering is complicated by tidal currents in the channel, which reach 3 to 3.5 knots.

To overcome this harbor problem, the Japanese, in 1914-1916, during their occupation of Korea, constructed a tidal basin which permitted ships to load and unload at dockside. This basin continued in operation until the Korean War, when the lock gates, machinery, and much of the masonry were severely damaged by demolitions by retreating UN forces. After the recapture of Inchon in March 1951, the U.S. Army's 50th Port Construction Company repaired the lock sufficiently to permit operation of the basin up to the present time. However, the combination of war damage, expanded use and limited maintenance from military necessity, normal wear since construction, and design deficiencies for present-day operational requirements created a need for major reconstruction. To meet this need a joint project was developed by the Republic of Korea and U.S. governments and the task of rehabilitating the tidal basin was assigned to the Corps of Engineers.

The tidal basin

The tidal basin is a 24.6-acre pool, 1,490 ft long by 717 ft wide. It is connected to the main harbor by a lock and a deep-water channel. The lock is 60 ft wide and can accommodate ships up to 420 ft long. Control of the lock is by two sets of miter gates. As high tide approaches, the gates are opened to permit the water level in the basin to reach the maximum height of that tide; then the gates are closed. Operation of the gates for ingress and egress of ships except at high tide of course takes water from the basin, but this expenditure plus normal leakage causes

Inchon tidal basin, in Korea, is currently being rehabilitated at a cost of two million dollars. The basin, 1,490 ft long and 717 ft wide, is connected to the main harbor by a 60-ft-wide lock and a deep-water channel.



Water pours from 100-ton leaf of a miter gate at Inchon harbor as it is lifted onto a dolly during the rehabilitation of the lock. When in place, all leaves are fully recessed into the lock walls to permit full utilization of the channel width.

an average drawdown of only about 2 ft during the cycle from high tide to high tide.

As in any rehabilitation work, the first task confronting the design engineers was to determine the economics of repair versus replacement. An initial survey was conducted in June 1957 by representatives of the Engineer, Eighth U.S. Army, and the U.S. Army Engineer District, Chicago. As a result of this survey, the design responsibility for the work was assigned to the Seattle District and the construction and overall responsibility for the project to the Far East District. The Seattle District conducted further investigations during the summer of 1958 and from these developed the analyses that formed the basis for the final plans and specifications.

Essentially the work of rehabilitation is divided into four major parts—the lock, the basin, the entrance guide wall, and miscellaneous facilities to improve operation. Of these, the lock and the south wharf in the basin posed the greatest problems as regards determination of existing conditions and the extent of the work required to put them in first-class condition.

The lock

Each miter gate consists of two hollow structural steel leaves 33.4 ft wide by 4 ft thick. Leaves at the basin end of the lock are 36 ft high and weigh 100 tons each; leaves at the harbor end are 44 ft high and weigh 120 tons. All are fully recessed into the lock walls to permit utilization of the entire channel width. Inspection of the leaves indicated that they were structurally sound and that no serious deterioration had occurred in the skin or the internal members. However, the pintles and caps were badly worn, all seals required replacement, and the walkways and supports were damaged beyond repair. Estimates of the cost to rehabilitate, including removal, sandblasting or scraping to bare metal, repair or replacement of damaged members, repainting, replacing of seals, pintles, and caps, constructing new walkways and replacing access ladders, and reinstalling the gates showed a cost, including a 50-percent contingency factor, of less than two-thirds the cost of new gates.

Stoplogs were needed to permit dewatering of the lock and basin, and three schemes for providing them were investigated. One rejected scheme employed stoplog sections and removable guides and the other a floating bulkhead, either to be placed across the extreme harbor end of the lock. Either scheme would have eliminated the necessity for culvert portal bulkheads. However, the extra steel required for the greater length, plus the fact that the floating bulkhead could only be placed with the water level at El. 15.0 ft or better, thereby necessitating much more pumping, caused these methods to be rejected in favor of the less expensive scheme adopted. The latter employs 7 stoplog sections of two-plate and three-plate girders with common skin plates, to be placed in rebuilt stoplog slots inside the channel.

Steel bulkheads will be placed over the culvert portals after the installation of the permanent sealing surfaces and guides, using rubber seals on the top and sides and a wood seal on the bottom. Water pressure plus final calking of the bottom by a diver will provide a tight seal. A small cofferdam was utilized to permit continued use of the lock during reconstruction of the stoplog slots, and the same cofferdam will be used for installing the sealing surfaces and guides for the culvert bulkheads. This method permits dewatering to begin at low tide, thus minimizing the amount of pumping required to clear the lock and basin. Even so, up to 155 hours of pumping will be required with the design capacity of the dewatering pumps at 9,000 gpm.

While the lock is dewatered, a final inspection will be made of its walls and bottom and of the gate sills and quoins. The investigations possible to date have shown that the sills and quoins will require considerable repair to assure tight seals when the gates are reinstalled. Repairs to lock walls and bottom are expected to be minor.

Since it was not possible to examine the culvert valves before the lock was dewatered, their actual condition was not known. However, assumptions were made and from these and a 100-percent contingency factor, it was determined that rehabilitation could be accomplished for approximately one-third the cost of new valves and frames.

A reasonably accurate inventory of the condition of the miter-gate and culvert-valve machinery was possible and it was determined that it could be brought to first-class shape, again for approximately one-third the cost of new. All shafts, bearings, motors and motor pinions will be replaced, as will certain gears. The only design change will be the addition of roller supports under the rims of the miter-gate bull gears to eliminate excessive wear of the shafts after repair.

There are, of course, many lesser items of work in the lock area. These include buildings for the harbor master and for maintenance, a complete new electrical system, a fuel-line crossover to replace an existing expedient, ceramic-tile tide gages, and access ladders. Minor seepage into pits and galleries will be eliminated by pointing up

Old South Wharf in Inchon tidal basin had suffered severe damage to outer row of piles and fender system. The wharf is being completely rebuilt, utilizing concrete piling and a concrete deck.

cracks and painting with an expansive material. Ventilation will be provided for machinery pits, and both esplanades will be repaved.

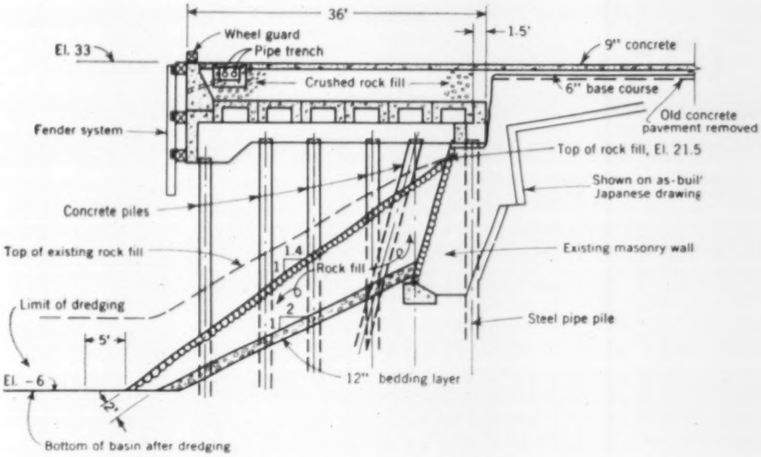


FIG. 1. Cross section of South Wharf, Inchon tidal basin, shows low-level concrete design adopted for the rebuilt structure. Main advantages of this type are low long-range maintenance and better utilization of Korean labor.

Reconstruction of South Wharf

Another important feature of the rehabilitation work is the South Wharf in the tidal basin, as has been mentioned. Determination of the best method to employ in reconstructing this wharf involves a number of considerations. The existing wharf was a concrete-deck structure about 30 ft wide and 1,200 ft long extending along the south side of the basin. The deck was supported on two rows of concrete piles and a heavy masonry retaining wall. Damage to the structure had been extensive. The fender system was completely gone and the outer row of piling was badly broken. An analysis of the pile spacing and deck construction indicated that the wharf was designed for a loading considerably less than the 500 to 600 psf used for modern dock design.

The need for a design that would permit a future railroad on the wharf compounded the problem of strengthening and repairing the existing structure. Further, dredging of the basin to the required depth of −6 ft at the front face of the wharf would undercut the toe of the slope supporting the retaining wall to a dangerous extent. For these reasons, it was found impractical to repair and strengthen the existing structure. Three possible types of reconstruction were considered—timber piling with a timber deck, concrete piling with a concrete deck, and a steel sheetpile bulkhead backfilled and paved with concrete.

The idea of a timber structure was quickly dismissed in spite of its lower first cost. Even properly treated timbers and piling have a relatively short life, and no local piling or timbers are available in Korea. Even with spudding, the driving of wood piles through the existing debris and riprap would be difficult and would require extensive clearing. And finally, maintenance of the structure would be difficult with the riprap slopes under the wharf.

Preliminary analysis of the remaining two solutions showed a 3-percent higher cost for the concrete structure over the sheetpile bulkhead and certain construction advantages for the latter. Preliminary designs were prepared for both these types of structure. The bulkhead design called for a continuous wall of the largest Z-section of sheetpiling normally rolled. The section would be reinforced at the point of maximum bending with two 5-in. x ½-in. flat bars. The wall would be supported about 17 ft below the top with continuous wales tied to a sheetpile anchor wall by rods of 3¼-in. diameter on 6-ft centers. The anchor wall would be 76 ft back of the bulkhead, beyond the critical slope line established by soil studies.

The superstructure of the present wharf and parts of the piling and masonry that would interfere with the installation of the tie rods and compaction of the fill would be removed. The backfill would consist of compacted well-graded granular material with a filter zone adjacent to the bulkhead to facilitate drainage and prevent loss of fines through weepholes in the bulkhead. The concrete slab over a gravel subbase would be designed to withstand a wheel load of 15,000 lb. Steel above low water would be painted and metal protection would be provided.

The concrete-pile design with which the bulkhead design was compared would consist of a low-level concrete wharf with a relieving platform consisting of 3 ft 9 in. of gravel fill and a 9-in. concrete slab (Fig. 1). A low-level structure was selected in preference to a high-level one as the gravel fill would provide greater flexibility for utilities and the future railroad loading. The low-level deck would also be low enough to prevent barges from drifting under the structure if the fender system should be broken, and the fender system could be braced at the bottom of the pile caps, eliminating the need for fender piles.

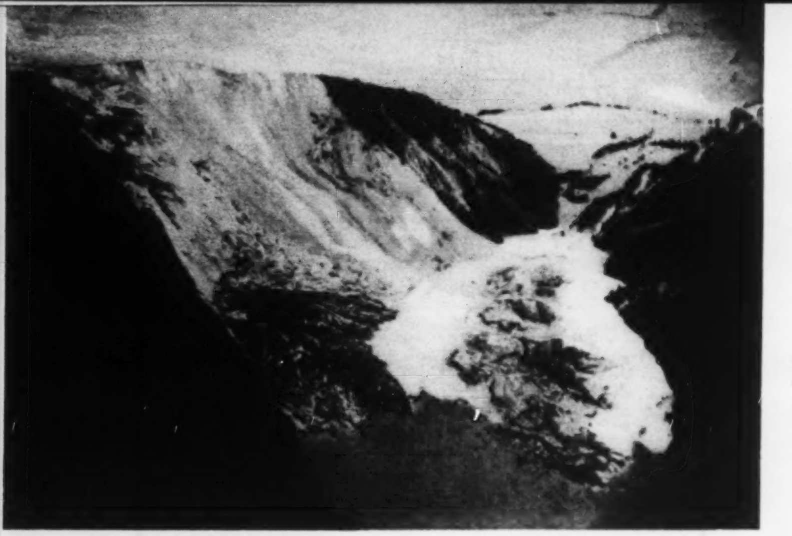
Adoption of the concrete-pile design would require more complete removal of the existing structure than the bulkhead design, and driving of the concrete piles would be hampered by any remaining debris or riprap. On the other hand, cement and reinforcing steel are more readily available than steel sheetpiling, which would have to come from the United States. Also, there would be no problem of metal protection, and maintenance would be less.

Data collected after the preliminary analysis was made indicated that the concrete structure would cost no more than the bulkhead structure. Since long-range maintenance would be less and greater use could be made of Korean labor, the concrete type was adopted.

Final design of the whole project was completed by the Seattle District in April 1959. In June, the Far East District awarded a lump-sum construction contract after soliciting bids from 16 United States and 3 Korean contractors. United States contractors failed to respond and the contract was awarded to the low Korean bidder, Hyun Dai Construction Company Limited, Seoul, Korea, for approximately $2,000,000, funded jointly by the U. S. and Republic of Korea governments.

Design was accomplished in the Seattle District, Corps of Engineers, under the direction of Noble A. Bosley, Chief, Engineering Division; Sydney O. Steinborn, Chief, Design Branch; Frank Louk, F. ASCE, Assistant Chief, Design Branch for Civil Works; and under the direct supervision of Harry W. Erickson, M. ASCE, Project Engineer.

Completion of the Inchon Tidal Basin is scheduled for the fall of 1960. When completed the basin will provide the United Nations Forces and the Republic of Korea with dockside loading and unloading facilities in what will be, because of its tremendous tidal range, one of the unique harbors of the world.



Slide deposits and slide scarp are seen on south wall of Madison Canyon. Quake Lake is in foreground.

MADISON CANYON SLIDE

KEITH R. BARNEY, F. ASCE, Major General, U.S. Army

Division Engineer, U.S. Army Engineer Division, Missouri River, Omaha, Nebr.

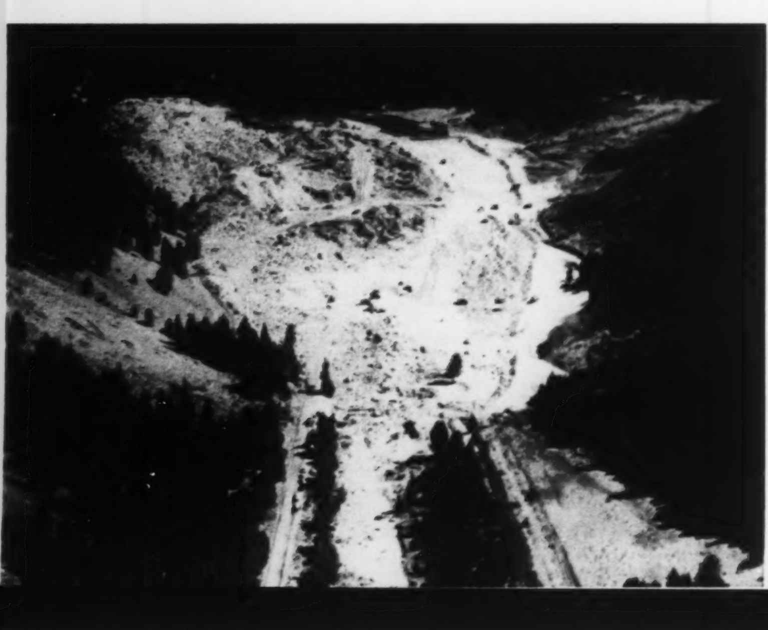
One of the greatest demonstrations of the force of nature in the recorded history of the North American continent occurred on Monday, August 17, 1959, at about 11:38 p.m., Mountain Time. This was the tremendous earthquake which struck the Rocky Mountain area and which triggered the large movement of rock ordinarily referred to as the Madison Canyon Slide. Some 43,000,000 cu yd of material moved into and across the Madison River forming a natural dam, extending over 4,000 ft along the canyon at the base and more than 200 ft high.

The Madison River, one of the best fishing streams in the world, rises high in Yellowstone Park and flows generally west and north to a junction with the Gallatin and Jefferson Rivers to form the Missouri River at Three Forks, Mont. (Fig. 1). The country between West Yellowstone and the plateau through which the Madison flows is high and rugged. Within this area the waters of the Madison River are stored in Hebgen Lake for subsequent regulated release from Hebgen Dam.

West Yellowstone has an elevation of about 6,600 ft and the river bed at the downstream end of the Madison Canyon had an elevation of about 6,235 ft. The canyon walls are steep and rise to elevations in the 8,000 to 10,000-ft range. A principal highway connecting the Helena area and the Yellowstone Park ran through the canyon. Before the earthquake there were numerous developments in the canyon, generally for recreation purposes and for the accommodation of tourists.

The earthquake, with an epicenter estimated to be somewhere in the southwestern part of Yellowstone Park, produced shocks of very great magnitude, measured at 7.5 to 7.8 on the Richter Scale.[1] (By comparison, Richter Scale readings of the great San Francisco and Tokyo earthquakes were 8.2 and 7.7, respectively; five movements in the recent Chile earthquakes ranged from 7.25 to 8.5.) There were numerous major after-shocks, including one at 12:59 a.m. on the 18th of August having a magnitude of about 6.5, another at 1:44 a.m. on that day having a value of 6.0, and numerous less severe shocks which continued literally for months.[2]

Over 1,800 separate tremors were counted up to December 2, 1959. It has been reported that the original earthquake lasted 35 minutes, one of the longest periods for an earthquake on record. A major fault line was developed, extending for miles generally



Water overflows spillway in a thin sheet before permanent spillway is cut. Quake Lake is in background. Note the braided stream on the downstream face of the natural dam.

Downstream toe of slide deposit indicates blocky nature of surface rocks—dolomites. These large rocks broke up badly, even with "gentle" handling.

south of Hebgen Dam. Relative vertical displacement of natural ground at this fault line amounted to as much as 20 ft in some localities.

Damage to structures was not severe. In the earthquake area, nine people are known to have died; it is estimated that there were 18 additional deaths of persons whose bodies were not recovered. Most of the deaths occurred at the major slide.

The slide mass blocked entrance and exit from the lower end of Madison Canyon, except for the hardiest of people on foot, and several breaks on the highway east of Hebgen Lake similarly denied entrance and exit from the upper end of the canyon. About 500 people who were in the area for the night were thus trapped. As part of the mobilization directed by the State of Montana Civil Defense organization, contractors in the employ of the State Highway Department bulldozed "shoofly" roads around the breaks of the highway along Hebgen Dam. By evening of the first day all vehicles whose drivers so desired were able to move out of the area.

Observers from the Corps of Engineers moved into the slide area the first day. They reported the Madison River completely cut off, a lake starting to form behind the slide mass, the damage to Hebgen Dam, seven miles upstream, and the continuing of earthquake aftershocks. Based on these reports, the Division Engineer and members of his staff arrived on the 20th of August, and the District Engineer, Garrison District, set up an office at West Yellowstone on the 21st. That same day the Governor of the State requested assistance from the Department of the Army with regard to alleviation of the flood hazards, and the Chief of Engineers instructed the Division to provide that assistance.

A major complication in seeking a practicable solution of the slide problem was the fact that the lake behind Hebgen Dam was nearly full at the time of the earthquake and that the dam, having been damaged, might possibly fail. The volume of water in Hebgen Lake was more than four times that which the area behind the slide deposits (named early, Quake Lake) could accommodate. Water from Hebgen Lake could be shut off at the dam as desired. It was highly desirable, however, to draw Hebgen Lake down as rapidly as possible to minimize the effects of possible dam failure, to permit inspection and repair of the dam and to have as much storage space as possible for the spring snowmelt runoff. However, until a spillway over the slide was completed in late October, only 58,000 acre-ft more than inflow had been evacuated from Hebgen Lake, corresponding to a drop in pool level of about 5 ft.

Prior to the slide huge dolomite masses on the south canyon wall acted as buttresses to support the thin-bedded schists and gneisses forming the main mountain mass. When the quake shattered the dolomite buttresses, the weaker schists were left without support, and sliding took place along bedding planes which dipped about 50 deg toward the river. By virtue of greater momentum, large shattered dolomite fragments of the buttress moved ahead of the rest of the slide material to the other side of the canyon, reaching a height of about 400 ft above the river bed. The whole slide mass seems to have moved, basically, in such a way as to preserve the same relative position which the materials composing the mass had before the movement started; that is, apparently very little tumbling action occurred within the sliding mass.

Some of the slide material came down from a height as much as 1,400 ft above the bed of the canyon. The top of the slide scarp now has extremely steep back slopes and numerous cracks of 1- to 6-ft displacement. Movement gages have indicated no additional displacement despite numerous

FIG. 1. Madison Canyon and the earthquake slide area near Yellowstone National Park.

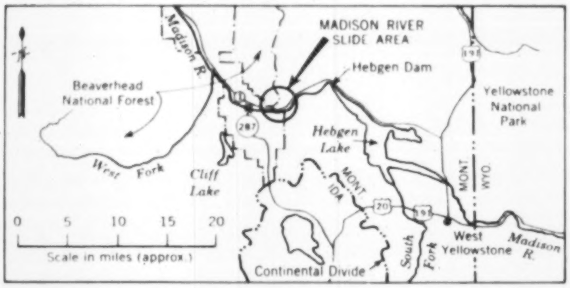
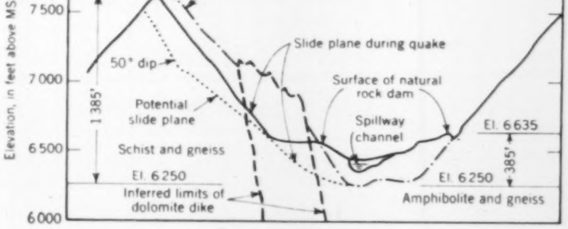

MADISON RIVER SLIDE AREA
Madison R.
Hebgen Dam
Beaverhead National Forest
287
Yellowstone National Park
Hebgen Lake
West Fork
Cliff Lake
MONT. IDA
MONT.
WYO.
191
20
191
0
5
10
15
20
Scale in miles (approx.)
West Yellowstone
Madison R.
South Fork
Continental Divide

FIG. 2. Geological cross-section through the slide, looking downstream.


8000
7500
7000
6500
6000
Elevation, in feet above MSL
El. 7635
Ground surface before quake
Slide plane during quake
50° dip
Potential slide plane
1 385'
Surface of natural rock dam
Spillway channel
El. 6635
385'
Schist and gneiss
El. 6250
El. 6250
Inferred limits of dolomite dike
Amphibolite and gneiss

earthquake aftershocks. A future earthquake in the area could trigger another slide.

Fortunately, the materials in the slide mass acting as a natural dam were arranged roughly in the manner that a designer would zone a rock-fill dam. Relatively impervious material upstream consisting largely of weathered gneiss and schist, with voids almost completely filled, acted and continues to act as an upstream blanket. The rest of the natural dam was graded from relatively competent gneiss and schist in the central portions to massive dolomite-quartzite blocks in the downstream toe. The downstream side originally had a flat slope of about 1 on 12, the upstream side, a slope of about 1 on 7, and the base width of the whole mass was from 5 to 8 times as great as is normally required in building a non-overflow rock-fill dam of the same general height.

It was concluded that the slide mass could be shaped and armored to act as a stable overflow dam. Some engineers ventured the opinion that all flow would pass through the slide material and very little, if any, would flow over its surface. Only a relatively small amount of water actually passed through the fill: perhaps 200 cfs percolated through just before overtopping of the mass occurred.

The overflow spillway

With Hebgen Dam releasing only inflow, it was estimated initially that Quake Lake would fill in 3 to 5 weeks, assuming that percolation through the slide deposits was negligible. Considering the small amount of time available before overflow would occur and the tremendous amount of mechanical excavation that would have been required to lower the crest of the slide mass 50 ft or more at the outset, it was initially decided to cut down the top elevation of the slide as much as time before overflow would permit while simultaneously shaping and armoring the spillway surface. This work was accomplished in the dry whereas the later work, which was designed to gradually lower the crest of the spillway 50 ft, was done under flow conditions. This prepared the spillway so it could be safely abandoned to nature during overflow.

The amount of overflow could be and was controlled to a major extent by specifying the releases from Hebgen Dam. In this connection especially, the Montana Power Company, owner of that dam, cooperated splendidly with the Corps of Engineers.

Examination of available data indicated that the maximum discharge from Hebgen Dam had been about 6,000 cfs for a period of over forty years. A design discharge of 10,000 cfs was adopted. It appeared that there was sufficient rock available having a median size of 2 to 3 ft or larger to armor the entire length of the spillway. Based upon a maximum flow of 10,000 cfs, a channel width of 250 ft (for thin, uniform spreading of the water sheet), a median rock size of 2 to 3 ft and larger, the best available data and computations indicated that the channel bed slope should not exceed 10 percent.

Poor surface material, particularly in the upstream and central reaches of the slide mass, was removed and replaced with at least 7 to 10 ft of armoring material. It was recognized that the design channel would require continuing maintenance, particularly where bed slopes exceeded 5 percent, and that considerable adjustment of the rock-fill configuration would take place under the action of overflowing water.

Construction followed the design plan, but not completely. Fig. 3 shows the plan and profile through the slide dam. Downstream from Station 12+00 the slide material seemed to consist almost entirely of very large rocks, as previously indicated. Because of this and because of lack of time before overflow, operations in this reach consisted primarily of transverse leveling to fill the undulating natural swale along the left side of the slide mass. As a result, from Station 12+00 to Station 6+00 the channel bed had an average slope of about 14 percent instead of the desired 10 percent.

The surface layers of rock in this reach were unavoidably shattered and crushed by bulldozing operations. Bulldozing operations also crushed and shattered the top two or three feet of the spillway surface armor in other reaches upstream. It was expected that much head cutting and gullying would occur in the lowermost reaches and would progressively work upstream. Overflow of the spillway occurred on September 10.

From September 10 to 25, head cutting and erosion were held in check by dumping in the largest rocks available and by limiting Hebgen releases. However, as better materials replaced poorer, it was possible to gradually increase the flows, but drawdown of Hebgen Lake was proceeding more slowly than desired. Furthermore, the supply of apparently good rock was being rapidly depleted by the hungry stream, which was building an aggradation fan downstream from the original toe of the slide mass.

As the interior of the rock mass became more and more exposed, it was found that the rocks were significantly smaller than had been supposed. Also it was found that in the course of their journeys down one side of the canyon and up the other, the rocks had actually been cracked and weakened far more than appeared on initial visual inspection. When subjected to relatively gentle handling by equipment, much of the dolomite, which appeared solid in relatively large stones, broke up in small pieces.

Drop structures studied

Rock drop structures built to elevations such that reaches between drop structures and all other reaches of the channel would have had bed slopes not exceeding 5 percent were considered. Remotely located quarries would have had to be opened and operated to provide large, competent rocks for the drop-structures. Time for construction and costs involved indicated that the drop-structure scheme was infeasible.

Lowering the spillway

The objective of the final phase of spillway work was to reduce sufficiently the volume of water stored in Quake Lake and the head on the slide dam to permit very high releases from Hebgen Dam, plus incremental flow, to pass over the spillway for an extended period without incurring any major risk of sudden failure of the slide mass after abandonment to the forces of nature. Thus, the spillway crest was to be lowered about 50 ft by making use of both the transporting power of the overflowing water and available mechanical equipment. By this time additional studies and repairs to the earth

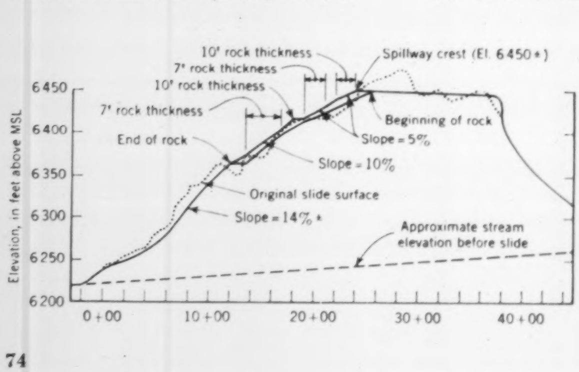


FIG. 3. Profile through the slide dam in Madison Canyon. Later the spillway crest was lowered 50 ft by mechanical equipment, aided by the force of flowing water.

To lower the surface of Quake Lake, heavy equipment was used to dig 700,000 cu yd from a pilot channel. Flowing water moved nearly two million cubic yards of additional material.

fill at Hebgen Dam had led to the consensus that the dam, built in 1915, was not likely to fail. The urgency of drawing down the 346,000-acre-ft Hebgen Lake remained.

Lowering the spillway commenced on Sept. 25 by mechanically loosening the armoring material on the crest, which by virtue of a sorting process of the flowing water, and continuing maintenance, had become highly resistant to movement by dynamic water action. Thus, initially, the cut-down proceeded rather slowly, and the lake level fell only a few inches a day. This was largely because energy slopes at and near the crest were insufficient to transport surface rocks.

Draglines were used to excavate a channel trough about 50 ft wide and near the crest, the width being largely dictated by the limit of reach of the draglines. Concentration of flows in a comparatively narrow width had the effect of increasing energy gradients with the result that as the trough deepened, more and more material was transported by the water. While draglines were excavating the trough and as more water concentrated in the 50-ft trench, other equipment worked in shallow depths.

Stockpiles of better rocks at various strategic points were ready to be pushed into the stream if a need arose to prevent the increasingly forceful stream from getting out of control during the cut-down. However, the stockpiles were not needed. The Quake Lake level was lowered without undue difficulty; in the last stages of spillway lowering the pool level dropped as much as 3 ft per day.

It is interesting to note that an energy slope of about 3 percent was required for appreciable hydraulic movement of exposed rocks. On Oct. 28, 1959, the Quake Lake level was reduced to El. 6400 and the lake contained only about 36,000 acre-ft of water. This compared with a peak at El. 6453 and a peak lake storage of 80,000 acre-ft. When the lake and overflow spillway were inspected in June 1960, there appeared to be no substantial structural change.

Equipment and quantities

The first equipment for reshaping the slide arrived on the job on August 23. All equipment was rented on an hourly basis through the Associated General Contractors of Montana under "Plan Bulldozer." The Government paid a fixed rate for each piece of equipment, which included pay for the operators, and fuel and maintenance of equipment. Principal equipment used consisted of: D-8 and D-9 dozers; 2-, 2½- and 3-cu yd shovels; 22-ton end-dump trucks; and 4-cu yd draglines. A 6-cu yd dragline, introduced in latter stages of construction, proved invaluable.

Quantities involved in different phases of the job may be of interest.

Excavation for spillway in the dry (initial)	600,000 cu yd
Spillway armoring in the dry (initial)	160,000 cu yd
Random fill in spillway bulldozed in from south side	100,000 cu yd
Rock hauled and placed in spillway (12 September through 9 October)	640,000 cu yd
Rock excavated from spillway during cut-down (50-ft lowering)	700,000 cu yd
Material removed by overflowing stream and deposited in delta	1,750,000 cu yd
Construction of access and haul roads	20 miles

Communications

Immediately after establishment of the project office at West Yellowstone, radio networks were set up to provide rapid two-way voice communication. Single side band (SSB) radio equipment was utilized to maintain radio communication between the project office and the Garrison District headquarters at Riverdale, N. Dak.

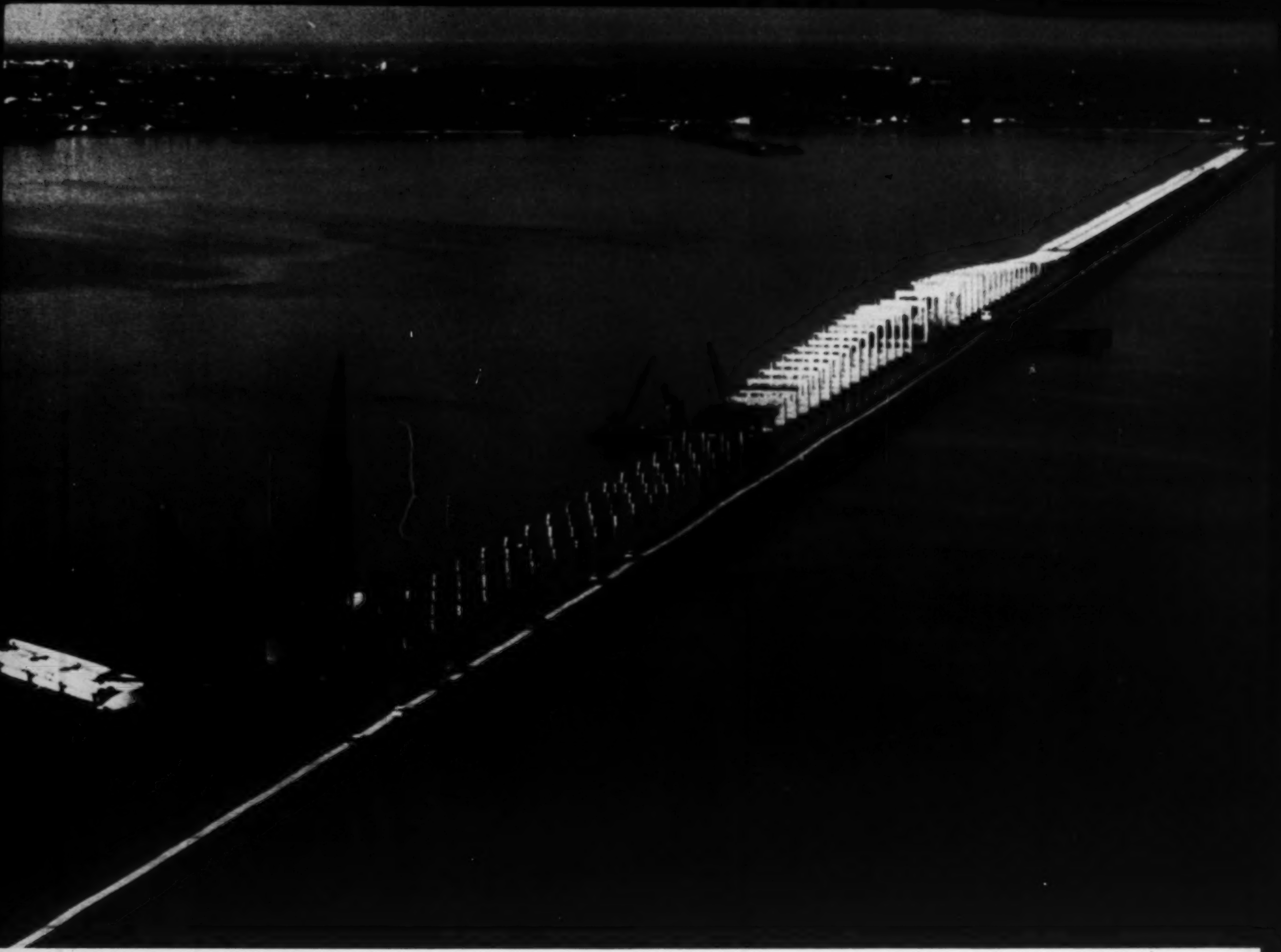
A frequency-modulated (FM) system of radio stations provided voice communication between the project office and base stations in office trailers located on the slide mass, downstream from the slide area, and at Hebgen Dam. FM radios installed in a number of automobiles and light trucks and several "handi-talkie" radio sets in the slide area were also tied into this system. Because of mountainous terrain between the slide area and the project office, it was necessary to install an automatic radio relay station, through which were funneled all radio communications between West Yellowstone and the base stations.

To conserve time, the project office at West Yellowstone utilized two single-engine, three-passenger monoplanes to transport key personnel between West Yellowstone and the slide area and to dispatch personnel and materiel between the District headquarters at Riverdale and West Yellowstone. These planes as well as a two-passenger helicopter were also used for aerial reconnaissance and for other errands as required. Their use materially expedited administrative support of the construction operations.

The execution of the work was under the direction of Lieutenant Colonel Walter W. Hogrefe, Garrison District Engineer, with supervisory personnel furnished by his District, supplemented by further supervisors, particularly in the field of rock handling, from the Kansas City and Omaha Districts. James L. Sherard, M. ASCE, and Stanley F. Gizienski, F. ASCE, were engaged as consultants on preliminary appraisal of the slide as a permanent dam. A Board of Consultants, consisting of Lorenz G. Straub, F. ASCE, Arthur Casagrande, F. ASCE, Edward B. Burwell, Jr., F. ASCE, and I. C. Steele, F. ASCE, was established to guide planning and execution in operations.

The valuable assistance rendered by Nicholas L. Barbarossa, F. ASCE, in the preparation of this paper is acknowledged.

(This paper was presented by General Barney at the ASCE Reno Convention before a joint session of the Soil Mechanics and Foundation Division of ASCE and the U. S. Committee of The International Congress on Large Dams.)



Driver installs piles near the navigation channel. The higher bents on each side of the channel are being cast in place.

Bridge towed 200 miles for erection

D. W. MILHAN, M. ASCE, Chief Engineer

Prestressed Concrete Products Company

Mandeville, La.

Prestressed piles, precast caps, and twin prestressed slabs for the 3½-mile bridge across Pensacola Bay, Florida, are being fabricated near New Orleans, La., and moved to Pensacola, Fla., for assembly, a distance of nearly 200 miles. The piles are 54 in. in diameter and up to 164 ft long, and the roadway slabs are 60 ft long by 31 ft wide. The fabrication yard at Mandeville, La., across Lake Pontchartrain from New Orleans, was built for making similar elements for the 24-mile-long Lake Pontchartrain Causeway, the longest bridge in the world. (See article by Myers Van Buren, F. ASCE, CIVIL ENGINEERING, February 1957, p. 73.) Units for the Pensacola Bay Bridge are transported by barge via the Intercoastal Waterway, a 200-mile distance, to the point of erection at Pensacola.

The new four-lane bridge parallels and will replace a deteriorated two-lane structure with a bascule span on Route U. S. 98. After the new bridge is in service, the bascule span of the old bridge is to be removed and the old bridge will become a fishing pier. The new bridge has a hump about a half mile from each end for the passage of small boats, and a rise with a fixed steel span near the center to provide a navigation channel with a 50-ft vertical, and a 125-ft horizontal clearance.

Bay foundation material

Foundation material across Pensacola Bay is mostly silt and uncompacted sand underlain at depths varying from 70 to 150 ft by a dense fine white sand suitable for the support of the bridge. Four-pile bents on 60-ft centers support two identical 31-ft-wide deck units that provide a 26-ft roadway in each direction. Each deck unit is composed of five girders and a 7-in. monolithic slab having a total depth of 4 ft 4 in. Each of the girders has a 6-in. web and a 16-in.-wide bottom flange to provide adequate bearing and to accommodate prestressing cables. Each girder is prestressed using twenty-eight $^7/_{16}$-in. stress-relieved strands. A 10-in. curb 3 ft wide is cast along one edge of the slab. After the deck slabs are erected, a 10-in. by 10-in. parapet supporting a 4-in. aluminum rail, and a dividing mall 5 in. high and 2 ft wide, are cast in place on each slab. Ten neoprene pads 8 in. by 1 in. by 1 ft 4 in. serve as bearings for each slab. A transverse joint, open 1 in. between slabs, and the neoprene bearings permit each slab to take its own expansion and contraction.

The structure requires the driving of 1,226 cylinder piles, with a total length of 150,000 ft, and the setting of 224 precast caps and 508 deck slabs. Four concrete piers built inside a cofferdam and supported on 14 BP 73 bearing piles were constructed in the field at the navigation channel to carry the fixed steel spans. Fifteen approach piers on each side of the channel are each supported by ten 54-in. cylinder piles, capped 1 ft 6 in. above the water with a concrete mat 14 ft wide, 5 ft thick, and 68 ft 4 in. long. Above this a three-column pier and cap were formed and cast in place at the proper elevation to support the precast deck slabs.

Work in the field on the bridge started November 1, 1958, and is scheduled for completion November 1, 1960. The work has been paced to the availability of funds and in general has been handled by one crew, which has driven the piles and set the caps and slabs. A supplementary crew assisted in the cast-in-place work.

Casting the piles

Carefully planned and accurately built facilities in the casting yard at Mandeville are the key to economical construction. The casting yard, methods, and equipment utilized on the Lake Pontchartrain Causeway formed the basis for the low-price bid and for the successful operation at Pensacola. More than 8,000 wood piles had been driven in the casting yard area to assure unyielding support for equipment for the casting and handling of the piles, and for three lines of deck and cap casting for the earlier use.

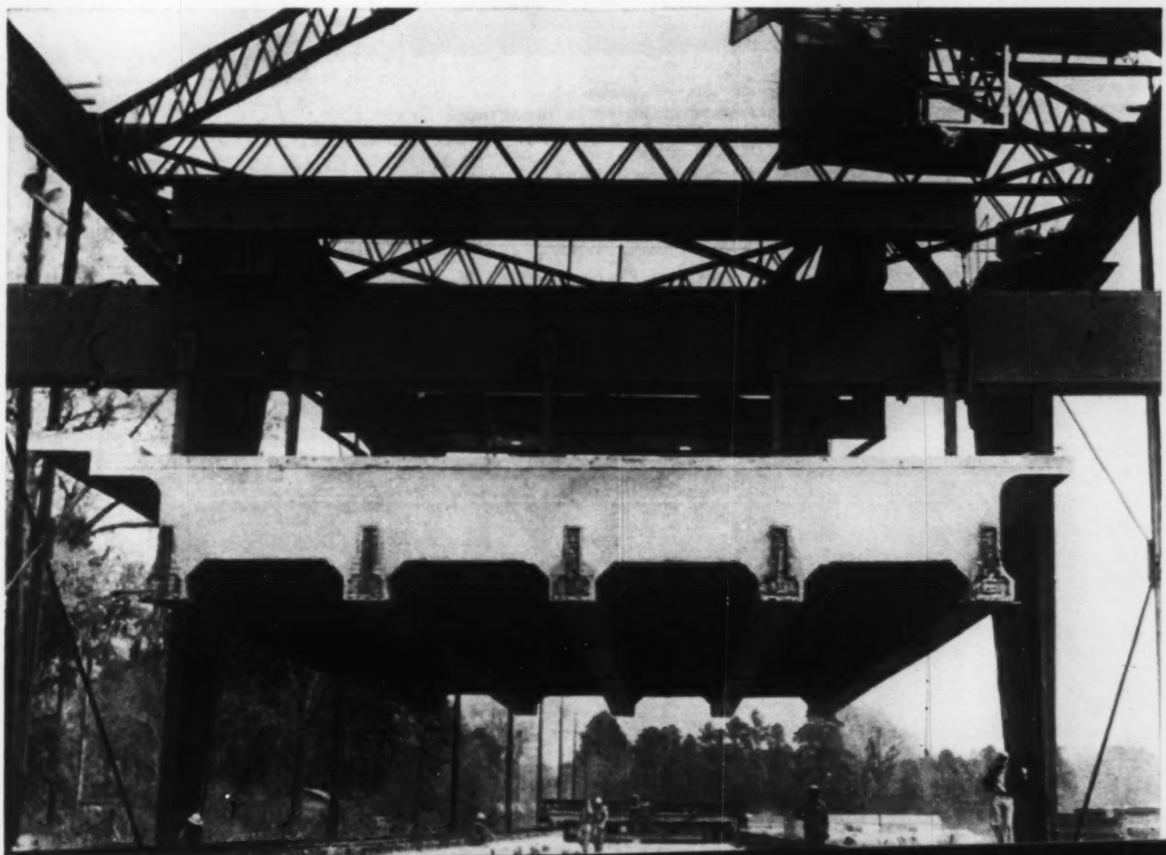
The pile casting unit has continued to work at approximately 50 percent of capacity, producing cylinder piles for various types of platforms in the Gulf for the oil industry, as well as other miscellaneous structures. Because of the smaller demand and the slower pace, only one of the three available lines for deck and cap casting were reactivated for the Pensacola project.

Piles are the Raymond International Inc. hollow-cylinder type, 54 in. in outside diameter with a wall thickness of 5 in. The piles are manufactured using the Cen-Vi-Ro process under a licensing agreement with Raymond International Inc. Pile sections are cast horizontally in 16-ft lengths using external steel forms spun on the Cen-Vi-Ro spinner. Concrete is placed in the spinning form in uniform layers by a small charging conveyor. External vibration is applied to the spinning form and a roller inside assists in compacting the concrete as it is centrifugally cast.

Two 1-cu yd Besser mixers furnish the mix, which has the very low water-cement ratio and zero slump necessary for this operation. During the final high-speed spin in the casting operation, some of the original mixing water is literally wrung from the inside of the rotating section as the heavier components displace the water to the inside. The resulting concrete is very dense, uniform in texture, and high in strength.

After the spinning operation is complete, a 10-ton overhead traveling crane picks the filled form off the spinner,

Slab section 60 ft long is lifted from casting bed by gantry. Note the equalizing setup that assures uniform lifting stress.



With a single-point pickup, a Wiley whirley crane lifts a long pile upright and sets it in template. Note pile leads, with jetting lines attached, stored on tower frame for future use.

upends the form and stores it vertically on a small car that carries it to the steam-curing building. The section is permitted to air dry for about a half hour before it is steam cured at 110 deg F to 140 deg F for 4 hours. The forms are stripped from the sections as they come out of the steam chamber and are cleaned, reoiled, and reassembled for their next use. The pile section is coated inside and out with curing membrane and is carried by means of a large fork-truck, mounted with a rotating grab unit, to storage for three or four weeks of curing. Ends of the casting forms are very accurately made and positioned to provide sections with an out-of-square tolerance of only $\frac{1}{32}$ in.

In casting the pile sections, 16 voids of $1\frac{3}{8}$-in. diameter are cast approximately in the center of the wall through which the prestressing wires are placed. After curing, the pile sections are laid horizontally in an assembly bed and supported on rollers. The curing membrane is sand blasted from the ends of the sections and the pile sections are rotated to align the holes with adjacent sections.

Twelve stress-relieved wires of 0.192-in. diameter are pushed through each of the 16 conduits. The joint between each of the sections is buttered with an epoxy-resin cement and then the pile is pulled together and the steel post-tensioned to 160,000 psi, two opposite ducts at a time, using Freyssinet 40-ton jacks.

The piles are rolled to the grouting station where a cement water slurry is pumped into the duct. When a full stream of grout appears at the far end, the duct is blocked and a pressure of 150 psi maintained for about five minutes. After about 48 hours of curing, the grout in the core ducts has reached 5,000 psi and is capable of transmitting the tensile stress of a wire through bond into the concrete, and the temporary anchorages used during the post-tensioning operation are removed and the wires burned off flush with the ends of the pile.

Piles are handled with a two-point pickup and carried to the water front and loaded onto 40-ft by 190-ft barges by a 75-ton traveling gantry. Nominally twelve piles are loaded on each barge for shipment to Pensacola.

Casting caps and deck spans

Three steel forms are used to cast the caps, each of which is 3 ft 6 in. wide, 4 ft deep, and 57 ft long. The caps are cast using conventional intermediate-grade reinforcing steel. Considerable attention is given to making the area where the slabs will bear both level and smooth. After placement of concrete, the caps are steam cured for 40 hours, then stripped from the forms and temporarily stored. The caps are handled and loaded, six on a barge, by a 200-ton gantry crane.

Because of the pace of the job, it was decided that six forms for casting the 60-ft deck spans would be required. These forms were designed at the precasting yard and were fabricated and assembled by Heppinstall Steel Company of New Orleans. A great deal of care was taken to be certain that the dimensional tolerances set forth by the Florida State Road Department were achieved. Concrete for the deck slabs and the caps is batched and mixed at a central plant and discharged into 2-cu yd buckets which are trucked to the point of placement and transferred to the forms by a crawler crane.

The slabs become the roadway without further surfacing. They are carefully screeded to grade with a suspended roadway finisher supported from tracks outside the forms. At the proper time the surface is completed with a broom finish. To gain strength the deck units are steam cured at about 110 deg F for a period of 40 hours. At this time a concrete strength of 4,000 psi has been reached, which permits the release of stress into the concrete. The roadway surface is finished with an inverse camber of $\frac{1}{2}$ in. to compensate for the prestressing camber, and the results achieved are quite satisfactory.

After the stress release the slabs are picked from the forms by a 200-ton gantry which transports the slabs to temporary storage or to barges for transport. Five cable anchorages are cast into each end diaphragm of the deck unit, and an equalizing pickup was devised for the crane to provide substantially equal pickup forces regardless of slight discrepancies in the elevations and locations of the anchorages. The pockets containing the cable anchorages are later dry-packed in the field after using an epoxy bonding agent to bond the new concrete to the old.

Transportation of precast units

Four deck-slabs are placed on a 36-ft by 130-ft barge for transporting. In general, two barge loads of slabs together with one or two barge loads of piles or caps make the tow to Pensacola via Lake Pontchartrain and the Intercoastal Waterway. An 800-hp tow boat is able to make the round trip, somewhat dependent on weather conditions, in about 70 hours. The tows are hampered occasionally by heavy fog, which makes it necessary to stop and tie up until the fog lifts.

Erection at the site

One large piece of floating equipment is the key to the bridge erection scheme. A 46-ft by 200-ft barge 10 ft deep mounts a 65-ton Wiley whirley crane on one end, to handle and drive piles. On the other end is mounted an A-frame derrick which sets the caps and 160-ton deck slabs. In addition, the barge has two four-drum hoists for handling four steel spuds and four anchor lines. The barge mounts a tower on one side to hold the pile-driving leads and jets when not in use. To stabilize the barge transversely while the long cylinder piles are being handled, it was necessary to attach pontoons 11 ft 6 in. by 80 ft by 10 ft deep to each side at the whirley end.

The piles are located and held by the use of a template similar to that used on the Lake Pontchartrain Causeway. The template is supported by two bents of piling previously driven and cantilevers ahead to position the piles to be driven. A supplemental template is used to position the outside battered piles at each bent. A Raymond 0000 single-action steam-hammer, with 48,750 ft-lb of energy, produced by a 15,000-lb ram falling 3 ft 3 in., is used to drive the cylinder piles. Two 6-in. jet pipes were used to assist in the pile-driving operation. Two Griffin pumps, each with a capacity of 1,200 gpm at 250 psi, are mounted on the deck of the barge and supply the water for jetting. When the pile tip approaches the required depth, jets are withdrawn and the pile is seated with the hammer.

The precast caps are lifted and set in place by the large derrick. Considerable care is exercised to place the cap in the proper location and at the proper elevation, after which a concrete plug is poured in the top 4 ft of each of the supporting piles, thus anchoring the cap to the piling to form a rigid portal bent.

The deck slabs are set with the derrick, by a method similar to that used for the original causeway. The supply barge is moved under the A-frame to permit pickup of one of the slabs and then the supply barge is moved out of the way so that the setting rig can move into the bridge and lower the slab onto the caps. It is evident that the cap-setting operation has to be correct or the deck slabs will not fit the anchor bolts. Small discrepancies in differential bearing are adjusted using stainless steel shims on the neoprene bearings.

The 400-ft continuous steel-girder section over the navigation channel was designed and furnished in three units for each roadway. The 154-ft end units are supported on piers spaced 123 ft from center to center and thus cantilever 31 ft toward the channel to support a 92-ft center suspended span. The steel units, somewhat in the same way as the concrete spans, were assembled at Mandeville, complete with the wood forms for the concrete deck. They were then towed to the bridge site and set in place by the derrick. This method of forming the concrete deck worked very satisfactorily although it did require additional deflection calculations on account of the suspended span, as well as careful measuring of the assembled steel to compensate for the imperfections.

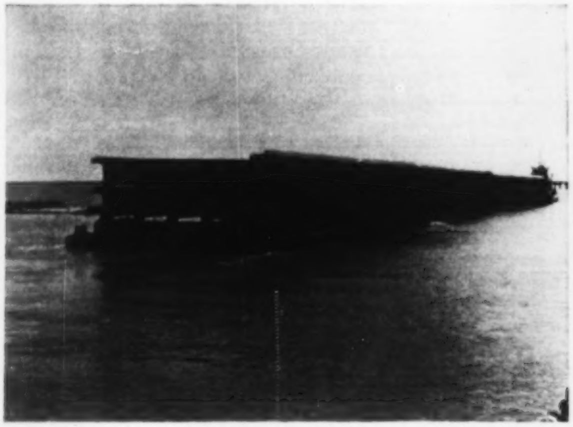
A barge-mounted concrete plant consisting of a Heltzel batch plant and a 1½-cu yd Smith turbine mixer was used to batch and mix the concrete for the cofferdam piers, approach piers, and the deck of the 400-ft fixed center navigation sections.

The Pensacola Bay Bridge was designed by the Florida State Road Department under the supervision of W. E. Dean, F. ASCE, Assistant Highway Engineer (Structures), and T. W. Jennings, A.M. ASCE, Engineer of Bridge Design. Gordon Warren, Resident Engineer, and Eugene Nettles, Project Engineer, are representing the Florida State Road Department at the job site supervising the construction.

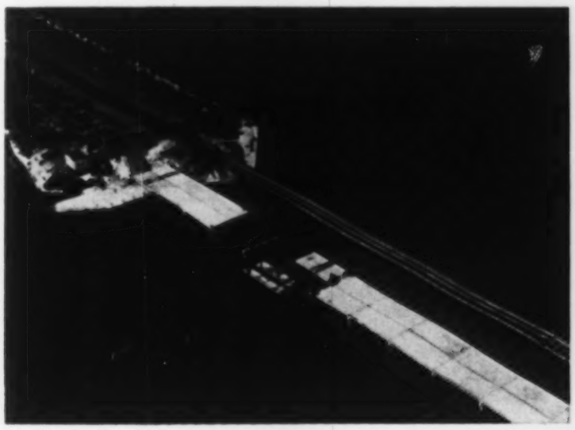
The contractor is a joint venture of Brown & Root, Inc., of Houston, Tex., and T. L. James & Co., Inc., of Ruston, La. The personnel for the contractor are Walton Gasaway, Project Manager, Joe Clifton, Field Engineer, and Gene Germany, Rigging Superintendent.

The cylinder piles, precast caps, and deck sections are supplied by Prestressed Concrete Products Co., Inc. of Mandeville, La. Casting-plant personnel are J. E. Walters, Vice President and General Manager, D. W. Milhan, M. ASCE, Chief Engineer, and Howard Goodger, Plant Superintendent.

Typical tow on 200-mile trip to Pensacola, Fla., transports eight slabs and twelve piles 54 in. in diameter and 164 ft long.



Derrick and driver barge are moved by deck winches to position slab on the accurately set bridge bearings.



THE CASE FOR PROFESSIONAL SCHOOLS OF ENGINEERING

THIS PAPER IS one of eleven presented at the Conference on Civil Engineering Education held at the University of Michigan, Ann Arbor, on July 6-8. (See p. 106.) Preconference meetings of leading educators led to an assignment of specific topics for presentation. Professor Fadum prepared this talk under the title of "Post-Baccalaureate Education." In it he proposes that recognition be given to the need of providing two distinct types of advanced study—one for the research-oriented student within the usual graduate school, the other for the practioner-minded student, to be administered within the engineering school.

A generation ago the typical undergraduate curriculum in engineering contained professional studies of considerable depth. It no longer does so—nor should it, at the expense of providing depth and breadth of coverage in other components of the curriculum that are essential if sound educational objectives are to be realized. The rate at which technology is developing requires that the student have this greater depth and breadth of general education. Within the framework of a four-year or even a five-year program, it is no longer possible to take a student sufficiently far into the professional aspects of engineering to prepare him adequately for a position of leadership on the frontiers of his profession—frontiers that are becoming continually more distant as compared to those of a generation ago.

The typical four-year curriculum of today is a good one; it is well designed to meet the educational objectives of the majority of our students. Many, however, would profit from additional study and a fair share of our students will need to be encouraged to go beyond the undergraduate level if the demand for engineers of high technical competence is to be met. Indeed the rate at which technology will advance will in no small measure depend on the number of qualified students who are given this opportunity.

In his preparation for advanced study, it is assumed that the student has been given good discipline in mathematics, the physical and life sciences, the social sciences and humanities, and the engineering sciences, as well as some experience with engineering methodology involving an application of these disciplines to the solution of real engineering problems. It is also assumed that he has had at least an introduction to the various specialty fields related to the branch of engineering he is pursuing. Finally, it is assumed that the student recognizes a need for advanced study and that he has the ability to profit from it.

Two types of program needed

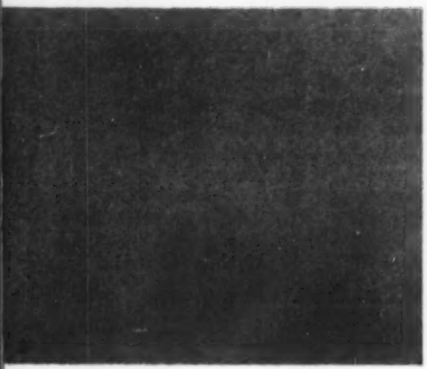
At least two distinctly different needs to be served by advanced study should be recognized. On the one hand, there is the need for the type of program that will provide academic discipline in preparation for scholarly pursuits including teaching and research. On the other hand, there is the need—a need that has been much neglected—for the type of program that will prepare the student in the best possible manner to pursue the practice of his profession. Whereas the first need is being met by traditional M.S. and Ph.D. programs that are usually administered by schools of graduate study, too little attention has been given to satisfying the need of the practitioner-oriented student. Yet the need for this type of program becomes ever more pressing as the course content of the undergraduate program is broadened to include more content in the areas of the social sciences and humanities, mathematics, and the basic and engineering sciences—this at the expense of the type of course content that identifies the curriculum as an engineering curriculum.

By its very nature engineering is a type of endeavor that is attractive to those who are primarily practitioner-minded. Programs of advanced study that emphasize research at the expense of developing skills in the application of knowledge would not appear to provide the type of program needed for this group. This does not negate the need for the traditional graduate programs in which the student seeks to achieve competence to "advance the frontiers of knowledge" by gaining some experience in research methodology and independent study. Engineering, like law and medicine, needs its fair share of such people. But we also need, and perhaps in greater numbers, people of high technical competence who can apply knowledge to the solution of real problems; that is, to make knowledge useful. This is the primary purpose of engineering and we should be proud of it. Indeed, if engineering is to survive, this type of endeavor must be given greater respectability.

In the fields of medicine and law, it is the practitioner who is recognized as the "doctor" or the "attorney." The practitioner in these fields is not the product of research-oriented curricula. His primary stock-in-trade is his ability to apply knowledge. He gains this competence from experience of a clinical nature, from case studies. The apparent success of this kind of education in preparation for the practice of these professions suggests that there is a need for a similar program of advanced study for practitioners of engineering.

The need for two types of advanced study programs is not unique to civil engineering. The need is equally compelling in the other branches of engineering and it has been so recognized. To quote from a recent paper by John F. Lee, head of the Department of Mechanical Engineering, North Carolina State College (*Consulting Engineer*, Jan. 1960, p. 136):

"The engineering profession must recognize what law and medicine recognized long ago. . . . Upon com-



R. E. FADUM, F. ASCE, Head
Department of Civil Engineering
North Carolina State College, Raleigh

pletion of the pre-engineering curriculum, the student engineer would . . . choose between two graduate curricula. One curriculum would lead to the doctor of philosophy degree, thereby preparing the student for a career in research. The other curriculum would lead to a doctor of engineering degree and would prepare the student for the practice of engineering.

"Fewer graduates with engineering degrees would be produced, but the level of competence would far exceed that now prevalent. Many of the routine courses found in many engineering schools would disappear from the university to reappear in technical institutes. The engineering graduate would command a much higher salary, but industry would not be plagued by the need to pay engineering salaries to those who are actually degree-bearing technicians." He concludes cynically "Engineering might even become a profession."

The need for the two types of advanced study programs is not satisfied by the all-too-typical types of graduate programs under the jurisdiction of an institution's division of graduate studies—the one requiring a thesis and proficiency in a foreign language, the other waiving these requirements. This is not a solution because it does not recognize the unique difference in objectives between the practitioner-oriented and the research-oriented student. Furthermore, all too frequently, the one alternative becomes a watered-down substitute for the other. It is an easy way out, or the only way out for a student who is not research minded or who has no inclination to spend time in the study of a foreign language.

To provide a proper alternative and to satisfy the need for an advanced program for the practitioner-oriented student, it is proposed that professional programs be established completely within the jurisdiction of the engineering division of an institution. The M.S. and Ph.D. programs for the research-minded student might properly remain the province of the graduate division of a university. The depth of professional training offered by the professional school could vary just as do programs of study leading to the M.S. and Ph.D. degrees, but sooner or later it would seem desirable to adopt a standard period for formal study to meet minimum requirements for professional recognition as has been done in law, medicine, and more recently in architecture.

In substance then, it is proposed that our engineering schools assume the role of professional schools in the same sense that schools of law and medicine function and that they assume primary responsibility for the program of study designed to meet the requirements of the practitioner-oriented student who aspires to become a professional in the true sense of the word.

Just as one cannot fully examine the undergraduate curriculum without considering objectives and requirements for education beyond this level, so is it not practical to discuss advanced education without considering the undergraduate curriculum to which it is to be fitted. I propose now to offer some suggestions for professional programs with due consideration of the preprofessional curricula to which they are adapted.

Professional program following a four-year curriculum

The typical four-year, ECPD-accreditable curriculum of today provides the student with a broad background in the various academic disciplines upon which engineering is based. It gives him an acquaintance with the specialty fields related to a given branch of engineering and introduces him to engineering methodology. Such a four-year curriculum allows the student little time for the development of skills in the artful aspects of engineering. During this short four-year period, the student's time must be spent on the kind of subject material that can be treated effectively within the environment of the classroom and that will fit him best to deal effectively with undefined problems of the future.

If the undergraduate curriculum is to achieve sound educational objectives—the development of abilities to reason logically, to analyze systematically, to synthesize knowledge, to judge fairly, to create, to be sensitive to esthetic values, and to understand the effects of one's efforts on the society in which one lives—there is little room for "bread-and-butter" courses designed to make the student immediately useful to his first employer.

On completion of such a program, the student should be prepared to engage in a wide variety of engineering-related activities, but it should be recognized that a wide gap must be bridged before he can qualify as a professional. With this academic background the student can, through a period of service as an apprentice, gain proficiency in the art of engineering and ultimately become qualified as a professional. However, to reach this goal more expeditiously, some additional formal education is necessary.

To suit the needs of such a student, it is proposed that, as a minimum, a curriculum consisting of a year of professional course work be made available. In this the student will have the opportunity to concentrate his efforts in pursuing in depth a specialty field such as structures, transportation, soil mechanics and foundation engineering, sanitary engineering or hydraulic engineering. The program would not require that the student gain proficiency in a foreign language or that he engage in a research project and prepare a thesis. It might well contain one or more project courses in which an opportunity would be given under competent guidance for him to gain experience in dealing with types of problems he will encounter in practice.

Such a program would not require a major and minor sequence. It might be primarily a year of related course work designed to give the student a greater depth of understanding in the specialty field of his choice. Emphasis would be placed on synthesis, analysis and design, and the sequence would be designed as a terminal sequence to provide a capstone for the program of academic preparation to enter practice.

Let me emphasize that this program is not intended to be an alternative for a student who does not qualify for admission to a graduate-division program because of failure to meet scholarship requirements. It is intended that the requirements for admission to the professional program be equally high, although perhaps based on different criteria from those for an academic course. It is to be hoped that the professional type of program will attract its fair share of "bright young men."

It is proposed that, upon completion of such a program, the student be awarded the professional degree of C.E. (or M.E., E.E., etc.). The fact that this degree has been given by some institutions to their alumni as a quasi honorary degree in recognition of the fulfillment of certain requirements related to professional practice need not prevent its use as an academic degree. In time, the stature of this degree will depend only on the extent to which it is adopted and the soundness of the program it identifies.

For those who aspire to become authorities in the practice of a given specialty, a three-year professional program leading to the degree of Doctor of Engineering is suggested. The professional program for this degree would differ from the one-year program in that the student's knowledge of mathematics and the basic and engineering sciences would need to be extended to provide a sufficient base to prepare him to cope with the most sophisticated types of problems that confront the modern-day practitioner. The capstone of this program would be a comprehensive project in which the student would be required to make independent studies and prepare a report for a major engineering facility.

Thus it is proposed that two professional programs be made available for the four-year-curriculum graduate who is practitioner-oriented—the one consisting of one year of study and leading to the degree of C.E., the other consisting of three years of study and leading to the degree of Doctor of Engineering. These programs would parallel those for the M.S. and Ph.D. degrees designed to meet the needs of the research-oriented student.

Professional program following a three-year pre-engineering curriculum

Conferees at the two planning sessions preceding this conference recorded themselves in favor, almost unanimously, of adopting a resolution advocating a pre-engineering undergraduate, degree-eligible program for all engineers. This would emphasize humanistic-social studies, mathematics, basic and engineering sciences. At least three-quarters of the program should be interchangeable among the various engineering curricula. This would be followed by a professional or graduate civil engineering curriculum based on the pre-engineering program and leading to the first engineering degree. A civil engineering degree would be awarded only at the completion of the professional or graduate curriculum.

The typical four-year curriculum of today that meets Engineers' Council for Professional Development criteria (a minimum of one academic year of basic sciences and mathematics, one year of engineering sciences, and one-half to one year in the humanities and the social sciences) will substantially fulfill the requirements of the pre-engineering program desired. If the common core, consisting of three-quarters of the four-year curriculum, is included in a program extending over a four-year period, the curriculum would be little different from that now commonly used. The postgraduate professional programs leading to the C.E. and Doctor of Engineering degrees and the research programs leading to the M.S. and Ph.D. degrees would be appropriate extensions of the undergraduate program. If, however, the pre-engineering program consisting of the whole of the interchangeable core is designed to be completed in three years, a greater variety of alternatives is open to the student.

If after completing the three-year pre-engineering curriculum the student should decide not to continue in engineering, he could either elect a one-year terminal sequence of courses to fit him for a career in such fields as sales or production, including construction, or he could elect a non-engineering related field of endeavor such as law, medicine or business. The professional schools would in most cases accept the pre-engineering program at least in partial fulfillment of entrance requirements. Should the student decide to continue in engineering, he would have the opportunity to elect a one-year terminal sequence of courses in one of the specialty fields such as structures or transportation, or he could devote the fourth year to preparation for advanced study.

For those students who complete the three-year pre-engineering curriculum and who elect to go beyond a four-year program, a choice between a career in teaching and research or a career in the practice of engineering can be made at the beginning of the fourth year. To prepare for scholarly pursuits, the student would spend his fourth year in preparation for admission to the graduate division and a program of studies leading to the M.S. or Ph.D. degree. His program of studies would be "science-oriented." If, on the other hand, he chose to pursue a career as a practitioner, he would spend the fourth year in gaining some experience in engineering methodology and he would be introduced to the various specialty fields related to the branch of engineering he is pursuing. He would follow this program with the fifth-year terminal sequence leading to the C.E. degree or the three-year sequence leading to the Doctor of Engineering degree. Thus, the graduate school and professional school programs as outlined are equally suited to the needs of students who have completed today's typical four-year engineering curriculum or to those who have completed a three-year pre-engineering curriculum followed by one year of additional study. The student who completes the pre-engineering curriculum in three years would have the advantage of being able to choose between a science-oriented or a practitioner-oriented program at the beginning of his fourth year and thus obtain better preparation for advanced study in either of these two directions.

Summary

In summarizing this discussion on post-baccalaureate education, it is proposed that recognition be given to the need of providing two distinctly different types of advanced study programs—the one designed to meet the needs of the research-oriented student, the other to meet the needs of the practitioner-minded student. Whereas the need for the first type of program is being met by the traditional graduate programs now in being and leading to the M.S. and Ph.D. degrees, the need for the second type has been almost neglected.

Inasmuch as engineering by its very nature is the type of endeavor that is attractive to one who is primarily practitioner-minded, it would seem reasonable to believe that there is a greater number of students who would desire the second type of program in preference to the first, if it were available. It is proposed, therefore, that professional programs leading to the degrees of C.E. and Doctor of Engineering be established as parallel to the programs leading to the M.S. and Ph.D. degrees.

To avoid confusion between the objectives of the two types of program, it is proposed that the professional programs be established completely within the jurisdiction of the engineering division of the institution. By assuming responsibility for such professional programs, our engineering schools will deserve to be recognized as professional schools in the same sense that schools of law and medicine are so recognized.

AMERICAN SOCIETY OF CIVIL ENGINEERS

1960 Annual Convention—Boston

Headquarters: Hotel Statler-Hilton, Boston, Mass. **Oct. 10-14, 1960**

REGISTRATION

Mezzanine, Hotel Statler-Hilton

Opens Sunday, Oct. 9, 2:00 to 5:00 p.m.

Monday, Oct. 10 through Thursday, 8:00 a.m. to 5:00 p.m.

Friday, Oct. 14, 8:00 a.m. to 1:00 p.m.

Registration fee for members and guests, $5.00. No fee for ladies or students.

HOTEL ACCOMMODATIONS

The Hotel Statler-Hilton, Arlington Street Park Square, will be the official headquarters for the Boston Convention. Special arrangements have been made to accommodate as many as possible at the headquarters hotel. Reservations will be accepted by the hotel, up to capacity, in the order that reservation requests are received. Send your request early to assure space at the headquarters hotel. For your convenience, a request form is provided on page 14[illegible]. Late requests will be assigned to nearby hotels.

SESSIONS OUTSIDE THE HOTEL

As certain sessions of the Convention will exceed the capacity of the headquarters hotel, arrangements have been made for the use of Perkins Hall, at 45 Providence St., directly across Park Square from the front entrance of the Statler-Hilton.

SESSIONS OF THE BOARD

The ASCE Board of Direction will be in session in the Hancock Room beginning at the following times:

Monday, Oct. 10, 9:00 a.m.

Tuesday, Oct. 11, 9:00 a.m.

Thursday, Oct. 13, 2:30 p.m.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained on the mezzanine floor throughout each Convention day. Mail and messages will be held for members at the information desk. Announcements seeking individuals will not be made in sessions of the Convention.

CIVIL ENGINEERING SHOW

Ballroom Assembly

9:00 a.m. to 6:00 p.m., Monday through Thursday
9:00 a.m. to noon, Friday

Firms supplying materials, equipment and services used in the various fields of civil engineering will participate in the Fourth Annual Civil Engineering Show. The exhibit will afford an opportunity to observe at first hand the latest developments available to the practicing engineer.

AUTHORS' BREAKFASTS

7:15 a.m. **Bay State Room**

Each Convention day briefing sessions are held for speakers, discussers, and program officials. Admission is by invitation only.

Emory Ireland, Chairman of the Technical Program Committee, will preside at these sessions.

MONDAY MORNING OCT. 10

Construction and Power Divisions, Joint Session

9:15 a.m. **Parlor B**

Presiding: Ralph W. Gunwaldsen, Chairman, Boston Program Committee, Power Division

9:15 **Operation Plowshare**
Gerald W. Johnson, Assoc. Director, Lawrence Radiation Lab., Livermore, Calif.

10:15 **Yankee Atomic Electric Plant**
H. T. Evans and L. C. Dawson, Stone & Webster Engineering Corp.

11:15 **Watertown Arsenal Reactor**
Alden K. Sibley, Brig. Gen., U. S. Army Corps of Engineers, New England Div.

Engineering Mechanics Division

8:45 a.m. **Room 406**

Presiding: H. S. Suer, Space Technology Labs., Inc., Los Angeles, Calif.

Session by Committee on Experimental Analysis and Analogues

8:45 **Theoretical and Experimental Studies of Laterally Loaded Thin Flat Plates**
W. A. Bradley, Assoc. Prof. of Applied Mechanics, Michigan State University, East Lansing, Mich.

9:15 **Use of Some Geometric Properties of Moire Fringes in the Analysis of Strains**
S. Morse, Assoc. Engr., Armour Research Foundation, Chicago, Ill.; A. J. Durelli, Prof. in Civil Eng., Illinois Inst. of Tech, Chicago; and C. Sciammarella, Assoc. Research Engr., Armour Research Foundation, Chicago

9:45 **Stresses Around Rectangular Openings in a Plate**
H. B. Phillips and I. E. Allen, Engrs., U. S. Bur. of Reclamation, Denver, Colo.

10:05 **An Electric Analog Computer for Limit Design of Structures**
M. Zaid, Technik Incorporated, Syosset, L. I., N. Y.; and F. L. Rider, Republic Aviation Corp., Farmingdale, N. Y.

Sanitary Engineering Division

9:15 a.m. **Parlor A**

Presiding: Darrell A. Root, Member, Technical Program Committee, Sanitary Engineering Division

9:15 **Sanitation Practices on New York City's Watersheds**
Stanley M. Dore

9:45 **Continuous Water Quality Monitoring**
Edward J. Cleary

10:15 **A 20-Year Study of Pollution of the Androscoggin River**
E. Sherman Chase

Soil Mechanics and Foundations Division

9:00 a.m. Ballroom

Presiding: Jorg O. Osterberg, Chairman, Exec. Committee, Soil Mechanics and Foundations Division

9:00 **Implications of the New Foundation Section of the Boston Building Code**

James F. Haley

Discussion

Harry A. Mohr and Arthur Casagrande

9:30 **Deep Foundations for the Prudential Center in Boston**

Donald Ball

10:00 **Interesting Results from Settlement Observations in the Boston Back Bay Area**

Arthur Casagrande

Stewart Avery

Waterways and Harbors Division

9:15 a.m. Georgian Room

Presiding: Alden K. Sibley, Chairman, Division Program Committee

Joint session by Coastal Engineering and Navigation and Flood Control Facilities Committees

Symposium on Hurricane Protection

9:15 **Studies of a Hurricane Barrier in the East Passage of Narragansett Bay**

John B. McAleer, New England Div., Corps of Engineers; and John Housely, Corps of Engineers, Waterways Exp. Sta., Vicksburg, Miss.

9:45 **Design of Providence, R. I., Hurricane Protection Project**

W. Martin, New England Div., Corps of Engineers

WELCOME LUNCHEON

Monday, Oct. 10

12:30 p.m. Ballroom

Invocation

Greetings from the City of Boston: Hon. John F. Collins, Mayor.

Speaker: Williams F. Keesler, Senior Vice President, First National Bank of Boston.

Subject: The Contribution of the Civil Engineering Profession to Urban Redevelopment

Presiding: Frank A. Marston, President, ASCE.

All members, guests and ladies are invited to attend. Tickets are available until 11:00 a.m. Monday.

Per plate: $4.50.

10:15 **Narragansett Bay Studies of Salinity, Temperature and Flushing, and Effects of Proposed Hurricane Barriers**

J. Vanderhoeff, New England Div., Corps of Engineers

Harry Simmons, Waterways Experiment Station

10:45 **Hurricane Parameters in New England Area**

Charles Gilman, U. S. Weather Bureau

MONDAY AFTERNOON

OCT. 10

Construction and Power Divisions, Joint Session

Nuclear Session

2:30 p.m. Parlor B

2:30 **Facilities for Aircraft Nuclear Propulsion Program at National Reactor Testing Station, Idaho**

W. E. Nims, LCDR, CEC, USN, U. S. Atomic Energy Commission

3:30 **Impact of Nuclear Power on Shore Facilities of the Navy**

W. J. Christiansen, CDR, CEC, USN, Bur. of Yards and Docks, USN

4:30 **Construction of a Nuclear Power Plant in the Greenland Icecap**

J. T. Rhett, Jr., Major, C. E., U. S. Army, Office of the Chief of Engineers

Wm. F. Reilly, Capt., C. E., U. S. Army, Office of the Chief of Engineers

Engineering Mechanics Division

2:30 p.m. Room 406

Presiding: E. F. Masur, Prof. of Eng. Mechanics, Univ. of Michigan, Ann Arbor

Session by Committee on Mathematical Methods

2:30 **Static and Dynamic Analysis of Conical Shells under Unsymmetrical Conditions**

J. E. Goldberg, Prof of Structural Eng.; J. L. Bogdanoff, Prof. of Structural Eng.; and Lee Marcus, Research Associate, Purdue Univ., Lafayette.

3:30 **Bending of Viscoelastic Plates on a Viscoelastic Foundation**

K. S. Pister, Assoc. Prof. of Structural Eng., Univ. of Calif., Berkeley

3:30 **The Method of Internal Constraints and Its Application to Static and Dynamic Problems**

E. Volterra, Prof. of Eng. Mechanics, Univ. of Texas, Austin

4:00 **Dynamic Elasto-Plastic Analysis of Structures**

M. L. Baron and Paul Weidlinger, Chief Engr. and Partner, Paul Weidlinger Associates, New York, N. Y.

Sanitary Engineering Division

2:30 p.m. Parlor A

Presiding: Darrell A. Root, Member, Technical Program Committee, Sanitary Engineering Division

2:30 **Removal of Flotables from Sludge Prior to Ocean Disposal**

R. J. Theroux and C. H. Lawrance

3:00 **Problems and Studies of Oil Field and Refinery Wastes in the Gulf Area with Particular Reference to Aquatic Life**

Albert Sparks

Soil Mechanics and Foundations Division

2:00 p.m. Ballroom

Presiding: Reginald A. Barron, Member, Division Exec. Committee

2:00 **Symposium on Soil Mechanics Research in the Boston Area**

T. W. Lambe

Roger Hirschfeld

K. A. Linnell

Waterways and Harbors Division

2:30 p.m. Georgian Room

Presiding: Alden K. Sibley, Division Program Committee

Theme: Coastal Engineering

2:30 **Predictions of Slopes of Equilibrium Beaches**

P. S. Eagleson, Prof., M.I.T.

3:00 **State Regulation of Coastal Structures**

Herbert C. Gee, Gee & Sanson, West Palm Beach, Fla.

3:30 **Behavior of New England Beach Fills**

Harry S. Ferdikie, New England Div., Corps of Engineers

ICEBREAKER PARTY

Monday, Oct. 10

5:30 to 7:30 p.m. — Ballroom

The Massachusetts Section will be host at this first general gathering of the Convention which is open, without charge, to those who have paid the registration fee and their wives. An ideal opportunity to greet old friends and new with cocktails and hors d'oeuvres.

BSCE DINNER

Monday, Oct. 10

7:30 p.m. — Georgian Room

Sponsor: Boston Society of Civil Engineers

Presiding: Arthur T. Ippen, President, BSCE

Speaker: Hon. John F. Collins, Mayor, City of Boston

Subject: Rebuilding a City

Members, guests, and their ladies are cordially invited to attend. A splendid opportunity to become acquainted with your Boston colleagues.

Per plate, $6.00.

SOIL MECHANICS GUIDED TOURS

Monday, Oct. 10

7:30-10:30 p.m.

Guided tours to:

Soil Mechanics Laboratory, Mass. Inst. of Technology

Soil Mechanics Laboratory, Harvard Univ.

TUESDAY MORNING

OCT. 11

Construction Division

8:45 a.m. — Parlor B

Presiding: Michael N. Salgo, Secretary, Construction Division

8:45 **Problems Encountered in the Construction of the Lt. William F. Callahan, Jr., Tunnel Between Boston and East Boston**

C. A. Richardson, Vice President and Manager, Perini Corp.

9:30 **Recent Construction Developments in Concrete Pipe Construction**

Hugh Kennison, Chief Engr., Lock Joint Pipe Co., East Orange, N. J.

CONDITIONS OF PRACTICE SESSIONS

It is to be noted that sessions sponsored by the Department of Conditions of Practice are scheduled at 11:00 a.m. on Tuesday, Thursday and Friday. All Technical Division Sessions will terminate by 11:00 in order to encourage attendance at the COP sessions.

Engineering Mechanics Division

8:45 a.m. — Perkins Hall

Presiding: H. L. Murphy, Chairman, Manual Sub-committee, Committee on Structural Dynamics

Theme: Protective Construction

To discuss "Protective Construction Manual" recently completed by Committee on Structural Dynamics, Engineering Mechanics Division

8:45 **Introduction: Philosophy of the Protective Construction Manual**

H. L. Murphy, Comdr., USN, Field Command, Defense Atomic Support Agency, Albuquerque, N. Mex.

9:00 **Nuclear Blast Loading on Structures**

Merit P. White, Member, Committee on Structural Dynamics; Head Dept. of Civil Eng., Univ. of Mass.

9:30 **Strength of Structural Materials and Elements under Dynamic Loading Conditions**

Robert J. Hanson, Member, Committee on Structural Dynamics; Prof. of Structural Eng., M.I.T.

10:00 **Analysis and Design Procedures for Blast-Resistant Structures**

N. M. Newmark, Member, Committee on Structural Dynamics; Head, Dept. of Civil Eng., Univ. of Illinois

Power Division

8:45 a.m.

Presiding: John F. Bonner, Member, Exec. Committee

8:45 **Model and Prototype Research on Fish Ladders**

B. M. MacLean and C. Cramer, Corps of Engineers

9:30 **Fish Handling Facilities for Baker River Hydroelectric Project**

W. W. Wayne, Stone & Webster Engineering Corp.

10:15 **Scoping Lower Monumental Plant**

B. F. Smith, Corps of Engineers

Sanitary Engineering Division

8:45 a.m. — Parlor A

Presiding: Darrell A. Root, Member, Division Committee on Technical Sessions

8:45 **Chlorination of Mixed Sewage and Storm-Water Overflows**

Thomas R. Camp

9:15 **Treatment of Mixed Overflows—New York City or Other Locations**

Samuel A. Greeley

Soil Mechanics and Foundations Division

9:00 a.m. — Ballroom

Presiding: Thomas M. Leps, Vice Chairman, Division Executive Committee

9:00 **Reaction of Piles to Lateral Loads and Moments**

John Lowe III, Tippetts, Abbett, McCarthy & Stratton, New York, N. Y.

9:30 **Increase of Bearing Capacity of Friction Piles by Electro-Osmosis**

Leo Casagrande
Larry Soderman
Richard W. Loughney

10:15 **Use and Abuse of Soil Mechanics**

Karl Terzaghi

Waterways and Harbors Division

8:45 a.m. — Georgian Room

Presiding Alden K. Sibley, Member, Division Program Committee

Theme: Ports and Harbors

Symposium on Materials for Wharf Construction

8:45 **Corrosion of Steel Piles in Salt Water**

Mr. Ayres

9:15 **Deterioration of Concrete Used for Wharf Construction**

9:45 **Damage to Timber Used for Wharf Construction**

Shu-T'ien Li, Consulting Engr., Mobile, Ala.

Department of Conditions of Practice

11:00 a.m. Georgian Room

Presiding: Frank L. Weaver, Chairman, Committee on Engineers in Public Practice

Session of the Committee on Engineers in Public Practice

Participation of Publicly Employed Engineers in Professional Society Activities—a panel discussion

Moderator: Don M. Corbett, Dist. Engr., U.S.G.S., Indianapolis, Ind.

11:00 **Attitude of Public Agencies as the Employer**

John G. Duba, Administrative Asst. to the Mayor of Chicago.

11:15 **Attitude of the Professional Engineer as the Employee**

Frank A. Butrico, Chief, Eng. Resources Program, U.S. Public Health Service.

11:30 **Attitude of the Public as the Beneficiary**

John E. Wright, Armco Drainage and Metal Products, Inc., Indianapolis, Ind.

11:45 **Discussion from the floor**

GENERAL MEMBERSHIP LUNCHEON

Tuesday, Oct. 11

12:30 p.m. Ballroom

Invocation

Speaker: Rear Adm. E. J. Peltier, CEC, U.S. Navy, Chief of Civil Engineers

Subject: The Contribution which the Civil Engineering Profession Can Make to World Development and Understanding

Presiding: Frank A. Marston, President, ASCE

All members, guests and ladies are invited to attend. Tickets are available until 10:00 a.m. on Tuesday.

Per plate, $4.75.

TUESDAY AFTERNOON OCT. 11

Construction Division

2:30 p.m. Parlor B

Presiding: Michael N. Salgo, Secretary, Construction Division

2:30 **Recent Developments in Steel Erection on Important Structures**

G. P. Bullard, Manager of Erection, Eastern Dist., Bethlehem Steel Co., Inc.

TOURS OF SANITARY ENGINEERING DIVISION

Tuesday, Oct. 11

2:30 p.m.

Trip to Lawrence Experimental Station, by bus.

Trip to Harvard or M.I.T. or both, by subway.

3:30 **Management Control in Heavy Construction**

Emmett H. Karrer, Prof., Civil Eng., Ohio State Univ., Columbus

4:30 **Construction of Special Facilities for Oil Production in Lake Maracaibo, Venezuela**

S. Mathis, Chief Engr., Creole Petroleum Co., Caracas, Venezuela

Hydraulics Division

2:30 p.m. Parlor A

Presiding: Arthur T. Ippen, Chairman, Division's Exec. Committee

Session by Tidal Hydraulics Committee

2:30 **Estuarial Sediment Transport Patterns**

H. A. Einstein, Prof. of Hydraulic Eng., Dept. of Civil Eng., Univ. of California

R. B. Krone, Asst. Research Engr., Sanitary Eng. Research Lab., Univ. of California

3:00 **The Analysis of Salinity Intrusions in Well-Mixed Tidal Estuaries**

Arthur T. Ippen, Prof. of Hydraulics, M.I.T.

D. R. F. Harleman, Assoc. Prof. of Hydraulics, M.I.T.

3:30 **Experimental Results on Salinity Intrusions in Estuaries**

Henry B. Simmons, Chief, Estuaries Sects., Waterways Experiment Sta., Corps of Engineers

4:00 **The Tide in the St. Lawrence River**

H. A. Neu, National Research Council, Ottawa, Canada

Engineering Mechanics Division

2:30 p.m. Perkins Hall

Presiding: N. M. Newmark, Member, Division's Committee on Structural Dynamics

Theme: Protective Construction

(Four papers from the several military departments)

2:30 **Protective Construction in the Army**

Clarence Renshaw, Brig. Gen., U.S. Army, Asst. Chief of Engineers for Military Construction, U. S. Army.

3:00 **Protective Construction in the Air Force**

A. M. Minton, Maj. Gen., USAF, Director of Civil Eng., USAF

3:30 **Protective Construction in the Navy**

E. J. Peltier, Rear Adm., USN, Chief, Bur. of Yards and Docks, and Chief of Civil Engrs., U. S. Navy.

4:00 **Protective Construction for Missile Bases**

W. E. Leonhard, Brig. Gen., USAF, Deputy Commander, Facilities, Air Force Ballistic Missile Div., Air Research and Development Command, USAF

Power Division

2:30 p.m. Room 406

Presiding: M. P. Aillery, Chairman, Division's Exec. Committee

2:30 **Economics of Cooling Ponds**

C. W. Greene, Jackson & Moreland, Inc.

3:30 **Niagara Power Project**

G. R. Rich, Chas. T. Main, Inc.

4:30 **Passamaquoddy Tidal Power Project**

J. W. Leslie, Corps of Engineers

Soil Mechanics and Foundations Division

2:00 p.m. Ballroom

Presiding: Stanley J. Johnson, Member, Division Exec. Committee

2:00 **The Constrained Modulus of Deformation of Soils**

Stanley D. Wilson

Symposium on Oil Storage Tank Foundations

2:30 **Recent Applications of Soil Mechanics to the Design of Oil-Storage-Tank Foundations**

Harl P. Aldrich, Jr.
Donald T. Goldberg

3:30 **Design, Construction and Performance of Large Oil Storage Tanks in La Salina, Venezuela**

Robert V. Whitman and T. W. Lambe

Waterways and Harbors Division

2:30 p.m. Georgian Room

Presiding: Alden K. Sibley, Division Program Committee

Theme: Regulation and Stabilization of Rivers by Open Channel Work

2:30 **Efficiency of Cape Cod Canal Bank Revetment**

H. G. Gamble, New England Div., Corps of Engineers

3:00 **Shoaling of Hudson River**

Representative from New York Dist., U.S. Army Corps of Engineers

3:30 **Latest Dredging Practice**

Ole P. Erickson, Erickson Engineering Co.

4:00 **Control of Ice**

Rene Dupuis, Quebec Hydroelectric Commission

Alternate: Chesapeake and Delaware Canal

C. F. Wicker, Philadelphia Dist., U.S. Army, Corps of Engineers

CONSULTANTS' DINNER

Tuesday, Oct. 11 Statler-Hilton Hotel

Boston dinner of the American Institute of Consulting Engineers

6:30 p.m. cocktails in ballroom
7:15 p.m. dinner in ballroom

Speaker: John B. Fisher, Administrative and Legislative Consultant, Boston, Mass., and Washington, D.C.

Subject: Portrait of a Citizen . . . 1960

Presiding: Richard H. Tatlow III, President, American Institute of Consulting Engineers

Per person: $16.00, including cocktails.

Engineers who wish to attend should address inquiries to the American Institute of Consulting Engineers, 33 West 39th Street, New York 18, N. Y.

TOUR

Tuesday, Oct. 11

7:30-10:00 p.m.

At Soil Mechanics and Arctic Construction and Frost Effects Laboratories, New England Div., U.S. Army Corps of Engineers.

WEDNESDAY MORNING

OCT. 12

ECPD INSPECTORS' BREAKFAST

Wednesday, Oct. 12

7:30 a.m.

Annual Business Meeting of ASCE

9:00 a.m. Georgian Room

9:00 **Annual Reports**

By the President
By the Executive Secretary

9:30 **Presentation of Awards**

10:30 **Installation of Officers**

11:00 **President's Inaugural Address**

AWARDS LUNCHEON

Wednesday, Oct. 12

12:30 p.m. Ballroom

Invocation

Speaker: Dr. James R. Killian, Jr., Chairman of the Corporation, Mass. Inst. of Technology

Subject: The Role and Responsibilities of the Engineer and Scientist in Modern Society

Presiding: In-coming President, ASCE

Presentation of Honorary Membership to:

Guy F. Atkinson, Engineer-Contractor, South San Francisco, Calif.

Solomon C. Hollister, Engineering Educator, Ithaca, N. Y.

Frank Kerekes, Engineering Educator, Houghton, Mich.

Fred C. Scobey, Consulting Engineer (in absentia), Berkeley, Calif.

All members, guests and their ladies are cordially invited to attend this event. Tickets available until 10:00 a.m. on Wednesday.

Per plate, $4.75.

WEDNESDAY AFTERNOON

OCT. 12

The 1960 Research Conference

Planned and conducted by the Research Committee, ASCE

2:30 p.m. Georgian Room

Presiding: H. B. Gotaas, Chairman, ASCE Committee on Research

2:30 **Research for Survival**

Arthur G. Trudeau, Lt. Gen., Chief of Research and Development, Dept. of the Army

3:00 **Research and Civil Engineering Education**

Nathan M. Newmark, Head, Dept. of Civil Eng., Univ. of Illinois

3:30 **Research and Professional Societies**

Arthur T. Ippen, Prof., Hydrodynamics Lab., Dept. of Civil and Sanitary Eng., M.I.T.

STUDENT PROGRAM

Wednesday, Oct. 12

8:00-8:45 a.m. Engineering Education Panel Breakfast
8:30-9:00 a.m. Student Registration at Northeastern
9:00-11:15 a.m. Engineering Education Panel at Northeastern
12:15-2:00 p.m. Annual Awards Luncheon at Statler-Hilton
3:00-5:00 p.m. 1960 Research Conference at Statler-Hilton
8:00-11:30 p.m. Dance at Tufts University

Student Chapters from at least twelve New England universities will have exhibits on display in the Statler-Hilton mezzanine throughout Convention week.

The Engineering Education Panel will consist of men from the consulting, construction, and education fields with a student acting as moderator.

BOSTON HARBOR TRIP

Wed., Oct. 12, and Thurs., Oct. 13

2:30 each day

This harbor trip will have as its objectives the locks on the Charles River Dam and the M.T.A. Station in Science Park.

By courtesy of the U.S. Corps of Engineers and the Waterways Division of ASCE, this trip will be available at no charge.

Since only 30 persons can be accommodated at one time, a total of 60 tickets will be available. Persons desiring to go will be given a ticket only on request. It is urged that members refrain from requesting these tickets unless they definitely intend to go on the harbor trip. If, for any reason, a member holding a ticket is unable to use it, he should give it to another member desiring to go or should return it to the registration desk.

ANNUAL DINNER DANCE and award of JOHN FRITZ MEDAL

Wednesday, Oct. 12

6:30 p.m. Assembly and cocktails in Georgian Room

7:30 p.m. Banquet in Ballroom

Award of 1961 John Fritz Medal to Stephen D. Bechtel, F. ASCE, President, Bechtel Corp.

9:00 p.m. Reception by President and Honorary Members

Dancing to the music of an outstanding Boston orchestra

For this event, special reservations can be made for tables seating ten persons each. Members may underwrite complete tables, or pool reservations with others.

The published seating list will close at 2:00 p.m., Tuesday, Oct. 11. Tickets purchased after that hour will be assigned to tables in order of purchase. Sale of tickets will be limited to the capacity of the Ballroom.

Dinner dress (black tie). Per plate, $9.00.

Mail orders for tables must be accompanied by a check in full, payable to the American Society of Civil Engineers, and a list of guests. Send order and checks to:

American Society of Civil Engineers
33 West 39th St.
New York 18, N. Y.

THURSDAY MORNING OCT. 13

Hydraulics Division

8:45 a.m. **Parlor A**

Presiding:* *Arthur T. Ippen, Chairman, Hydraulics Division

Session by Hydromechanics Committee

8:45 Anistropic Turbulence and Wall Effects in Open-Channel Flow

Paul G. Mayer, Assoc. Prof. of Civil Eng., Georgia Inst. of Technology

9:15 The Flow of Sand-Water Mixtures in Horizontal Pipes

Norbert L. Ackermann, Prof. of Civil Eng., Univ. of Khartoum, Sudan, Africa

Thomas E. Stelson, Head, Dept. of Civil Eng., Carnegie Inst. of Technology

9:45 Effects of Roughness, Spacing in Rigid Open Channels

William W. Sayre, Asst. Civil Engr., U. S. Bur. of Reclamation, Denver, Colo.

Maurice L. Albertson, Director, Research Foundation, Colorado State Univ.

10:15 The Mechanics of Washout of an Erodible Fuse Plug

E. Roy Tinney, Head, R. L. Albrook Hydraulic Lab., Washington State Univ.

Engineering Mechanics Division

8:45 a.m. **Perkins Hall**

Presiding: C. E. Cutts, Member, Committee on Mechanical Properties of Materials

Session by Committee on Mechanical Properties of Materials

8:45 Nuclear Magnetic Resonance for Determination of Moisture Content

R. L. Blaine, Chief, Concreting Materials Sect., National Bur. of Standards, Washington, D. C.

9:15 Significance of the Ultrasonic Pulse Technique as Related to Reinforced Plastics

Albert G. H. Dietz, Prof. of Building Eng., Dept. of Civil and Sanitary Eng., M.I.T., Cambridge

9:45 Visco-Elastic Behavior of Aluminum from Sonic Tests

Tien S. Chang, Assoc. Prof. of Eng. Mechanics, V.P.I., Blacksburg, Va.

Highway Division

8:45 a.m. **Ballroom**

Presiding: Fred Burggraf, Director, Highway Research Board

Session by Committee on Research

8:45 Illinois Road Test

W. B. McKendrick, Jr., Project Director, AASHO Road Test

9:15 Panel Discussion: Present and Needed Research

Ellis L. Armstrong, Commissioner, Bur. of Public Roads, Washington, D. C.

Francis N. Hveem, Materials and Research Engr., Calif. Div. of Highways

Jack E. Leisch, DeLeuw, Cather and Co.

K. B. Woods, Prof. of Highway Eng., Purdue Univ.

Sanitary Engineering Division

8:45 a.m. **Parlor B**

Presiding: Darrell A. Root, Member, Division Committee on Technical Sessions

8:45 Treatment of Water Containing Low-Level Radioactive Contamination

John H. Foster

9:15 Status of Solids-Contact Units for Water Treatment in the U.S. and Elsewhere

A. A. Kalinske

9:45 The New Solids-Contact Water Treatment Plant at Omaha, Nebr.

Richard O. Davis

Structural Division

8:45 a.m. **Georgian Room**

Presiding: Saul Namyet, Chairman, Session Program Committee of the Division

8:45 Men, Money, Research and the University

Gene M. Nordby, Head, Civil Eng., Univ. of Arizona, Tucson, Ariz.

9:15 Analysis of Structural Safety

Ernest Basler

9:45 Safety, Reliability and Structural Design

A. M. Freudenthal

10:15 Applied Statistics in Experimental Investigation

Paul Irick

Department of Conditions of Practice

11:00 a.m.

Presiding: Lawrence A. Elsener, Vice Chairman, Department of Conditions of Practice

Session of Committee on Engineering Education

Report on Conference on Civil Engineering Education

11:00 Introductory remarks

Alfred R. Golze, Acting Commissioner, U.S. Bureau of Reclamation,

GENERAL MEMBERSHIP LUNCHEON

Thursday, Oct. 13

12:30 p.m. **Ballroom**

Invocation

Speaker: G. Brooks Earnest, President, Fenn College, Cleveland, Ohio

Subject: Comments on Engineering Education

Presiding: Newly-installed President, ASCE

All members, guests and their ladies are cordially invited to attend this event. Tickets available until 10:00 a.m. on Thursday.

Per plate, $4.50.

Washington, D. C.

11:15 **Background of Conference**

William P. Kimball, Dean, Thayer School of Eng., Dartmouth Univ., Hanover, N. H.

11:30 **Summary of Conference**

Cornelius Wandmacher, Assoc. Dean, Civil Eng. Dept., Univ. of Cincinnati, Cincinnati, Ohio.

11:45 **Questions and discussion from the floor**

THURSDAY AFTERNOON

OCT. 13

City Planning Division

2:30 p.m. Parlor B

Presiding: J. Cal Callahan, Member, Division's Exec. Committee

Theme: The Financing of Urban Mass Transit Facilities

2:30 **Economics of Urban Transportation**

Luther Gulick

3:00 **Financing of Bus and Rail Systems**

Walter McCarter

3:30 **Monorail vs. Conventional Rapid Transit**

Sidney H. Bingham

4:00 **The Rail Commuter Problem**

Walter Patchell

Engineering Mechanics Division

2:30 p.m. Perkins Hall

Presiding: J. F. Throop, Vice Chairman, Committee on Mechanical Properties of Materials

Session by Committee on Mechanical Properties of Materials

2:30 **Stress-Strain Characteristics of Materials by Strain Wave Propagation**

Glenn Murphy, Prof. and Head of Theoretical and Applied Mechanics, Iowa State Univ., Ames.

3:00 **Shrinkage, Swelling and Creep in Cement**

A. P. Hrennikoff, Prof. of Civil Eng., Univ. of British Columbia, Vancouver, B. C.

3:30 **Photoelasticity Applied to Material Properties**

G. U. Oppel, Dept. of Eng. Mechanics, Penn. State Univ., University Park.

4:00 **On the Theory of Asymmetrically Laminated Aeolotropic Plates**

Albert G. H. Dietz, Prof. of Building Eng., Dept. of Civil and Sanitary Eng., M.I.T., Cambridge.

Yehuda Stavsky, Asst. Prof., Dept. of Civil and Sanitary Eng., M.I.T., Cambridge

Highway Division

2:30 p.m. Ballroom

Presiding: Wilbur S. Smith, Chairman, Division's Traffic Engineering Committee

2:30 **Integrated Parking and Expressway Demands**

J. Faustman, Consulting Engr., Sacramento, Calif.

3:00 **Assignment of Future Traffic to Urban Networks**

Glenn Brokke, Highway Research Engr., U. S. Bur. of Public Roads, Washington, D. C.

3:30 **Expressway Earnings in Urban Areas**

Evan Gardner, Director, Economic Research, Penn. Dept. of Highways, Harrisburg, Penn.

4:00 **Arterial Route Planning for Satellite Communities**

Archie N. Carter, Carter, Krueger & Associates, Inc., Minneapolis, Minn.

Hydraulics Division

2:30 p.m. Parlor A

Presiding: Arthur T. Ippen, Chairman, Division's Exec. Committee

Session by Sedimentation Committee

2:30 **Research Needs in Sedimentation**

H. A. Einstein, Prof. of Hydraulic Eng., Dept. of Civil Eng., Univ. of California

3:00 **Effect of Bridge Construction on Scour**

H. K. Liu

F. M. Chang

3:30 **Sediment Distribution in S.C.S. Flood Water Retarding Structures**

H. G. Heinemann

Structural Division

2:30 p.m. Georgian Room

Presiding: Saul Namyet, Chairman, Division's Session Program Committee

2:30 **Columns in Plastically Designed Structures**

T. V. Galambos, Fritz Lab., Lehigh Univ.

2:45 **Composite Design**

G. C. Driscoll, Fritz Lab., Lehigh Univ.

C. Culver, Fritz Lab., Lehigh Univ.

3:00 **Plastic Design and Multistory Frames**

G. C. Driscoll

3:15 **Application of Electronic Computers to Dynamic Response Problems**

R. O. Belsheim, U.S. Naval Research Lab.

3:30 **Electronic Computer Earthquake Analysis**

G. Berg, Univ. of Michigan

3:45 **Theoretical Studies of Structural Behavior**

A. S. Veletsos

4:00 **Research at Pennsylvania State**

J. Marin

4:15 **Research in Fracture Mechanics**

W. T. Hall, Univ. of Illinois

4:30 **Research at Armour Research Foundation**

R. W. Sauer

5:00 **Basic Research on Structural Engineering of Flight Vehicles**

R. R. Heldenfels, National Aeronautics and Space Admin.

5:15 **Stability of Stiffened Panels**

A. Ostapenko, Fritz Lab., Lehigh Univ.

5:30 **Corrugated Thin-Gage Beam Webs**

J. M. English, Univ. of California

MEN'S SMOKER

Thursday, Oct. 13

8:00 p.m. Georgian Room

An evening of light entertainment and good fellowship, with refreshments and snacks. Alumni events scheduled for Thursday evening will be concluded in ample time for the Smoker.

Ladies will be occupied with a separate group activity on this "night out" for the men.

FRIDAY MORNING

OCT. 14

Engineering Mechanics Division

8:45 a.m. Parlor B

Presiding: J. E. Cermak, Chairman, Division's Committee on Fluid Mechanics

Session by Committee on Fluid Dynamics

8:45 **Introductory remarks**

Donald R. F. Harleman, Chairman, Task Committee on Mechanics of Stratified Flow: Dept. of Civil Eng., M.I.T., Cambridge.

9:00 **Interfacial Mixing in Stratified Flow**

Hunter Rouse, Director of Iowa Inst. of Hydraulic Research, Iowa City.

Enzo O. Macagno, Research Engr., Iowa Inst. of Hydraulic Research, Iowa City.

9:30 **Stability in a Continuously Stratified Fluid**

Louis N. Howard, Assoc. Prof. of Mathematics, M.I.T., Cambridge.

Philip G. Drazin, Research Assoc. in Meteorology, M.I.T., Cambridge.

10:00 **Jets in Stratified Fluids**

Robert R. Long, Prof., Civil Eng. Dept., The Johns Hopkins Univ., Baltimore.

City Planning Division and Highway Division, Joint Session

8:45 a.m. Ballroom

Presiding: John O. Morton, Chairman, Highway Division's Exec. Committee

Session of Highway Division Committees on Urban Transportation and Geometrics of Highway Design, and City Planning Division

Theme: An Appraisal of Design and Operation of Urban Freeways

8:45 **Special Freeway Study and Analysis**

Joseph Barnett

Hydraulics Division

8:45 a.m. Parlor A

Presiding: A. T. Ippen, Chairman, Division's Exec. Committee

Session of Hydrology Committee

8:45 **Estimating Potential Evapo-transpiration**

W. Russell Hamon, Research Assoc., Travelers Insurance Co.

9:15 **Use of High-Speed Analog Computer for Routing of Storm Rainfall through a River Basin**

Henry M. Paynter, Assoc. Prof. of Mechanical Eng., M.I.T.

9:45 **Infiltration of Fluids in Dry Porous Media**

A. I. Johnson, Hydrologic Lab., U.S. Geological Survey

W. N. Palmquist, Hydrologic Lab., U.S. Geological Survey

10:15 **Use of Digital Computers in Computing Flow Hydrographs from a Network of Subareas**

W. L. Northrop, Kansas City Dist., Corps of Engineers

C. W. Timberman, Kansas City Dist., Corps of Engineers

Structural Division

8:45 a.m. Georgian Room

Presiding: Saul Namyet, Chairman, Division's Technical Program Committee

8:45 **Post-Elastic Flexural Behavior of Rolled Steel Sections**

Herbert A. Sawyer, Jr., Univ. of Connecticut

Yeichel Weitsman, Univ. of Connecticut

9:15 **Dynamic Behavior of Girder Bridges**

Edward N. Wilson, New York Univ.

James Michalos, New York Univ.

9:45 **Wind Tunnel Tests on Wind-Induced Vibrations in Structural Members**

William Weaver, Jr.

10:15 **The Application of Finite Differences to Some Structural Problems**

Frederick G. Lehman, Newark Univ.

Surveying and Mapping Division

8:45 a.m. Room 406

Presiding: C. L. Miller, Division's Program Committee

8:45 **Information Systems and Civil Engineering**

C. L. Miller, Assoc. Prof. of Civil Eng. and Director, Photogrammetry Lab., M.I.T.

9:30 **Cloud Mapping from the Tiros Meteorological Satellite**

Arnold G. Glaser, Manager, Geophysics Dept., Allied Research Associates, Inc., Boston, Mass.

10:15 **Computer Programming Languages and Survey Computations**

W. A. Briggs, Research Staff, Civil Eng. Computer Lab., M.I.T.

Department of Conditions of Practice

11:00 a.m. Georgian Room

Presiding: Lawrence A. Elsener, Chairman, Committee on Conditions of Practice

Session of Committee on Employment Conditions

11:00 **Examination of the Civil Engineer's Compensations**

Oscar S. Bray, President, Jackson & Moreland, Boston, Mass.

11:30 **Survey of Environmental Conditions in Exemplary Engineering Offices**

Irving F. Ashworth, Chief, Office of Technical Controls, Dept. of City Planning, New York, N. Y.

GENERAL MEMBERSHIP LUNCHEON

Friday, Oct. 14

12:30 p.m. Ballroom

Invocation

Speaker: Brig. Gen. Alden K. Sibley, U.S. Army, Div. Engr., U.S. Army Eng. Div., New England

Subject: Engineering and the Basic Sciences

Presiding: Newly-installed President, ASCE

All members, guests and their ladies are cordially invited to attend this event. Tickets available until 10:00 a.m. on Friday.

Per plate, $4.50.

FRIDAY AFTERNOON

OCT. 14

City Planning Division and Highway Division, Joint Session

2:30 p.m. Ballroom

Presiding: John C. Kohl, Chairman, Committee on Mass Transportation, City Planning Division

Theme: The Impact of Modern Rapid Transit Facilities

2:30 **The Congress Street Rapid Transit Line in Chicago**

Virgil E. Gunlock, Chairman, Chicago Transit Authority

3:00 **Studies of the New Highland Line in Boston**

Gregory B. Wolfe, Director of Research, Greater Boston Economic Study Committee

3:30 **The West Side Extension of the Cleveland Rapid Transit System**

George Ihnat, Exec. Asst., Cleveland Transit System

4:00 **Government and Transit Cooperation in Developing High-Speed Service**

John A. Bailey, Deputy Managing Director, City of Philadelphia

Engineering Mechanics Division

2:30 p.m. Parlor B

Presiding: W. D. Baines, Vice Chairman, Division's Committee on Fluid Mechanics

Session by Committee on Fluid Dynamics

2:30 Calculation of Potential Flow with Free Boundaries

Garrett Birkhoff, Harvard Univ., Cambridge, Mass.

3:00 Variational Methods in Fluid Dynamics

J. W. Delleur, Assoc. Prof. of Hydraulic Eng., School of Civil Eng., Purdue Univ., Lafayette, Ind.

3:30 Application of Digital Computers to Flow in Open Channels with Abruptly Changing Profiles

Albert G. Mercer, Instructor, St. Anthony Falls Hydraulics Lab., Univ. of Minnesota, Minneapolis.

4:00 Analysis of Correlation Functions of Wave Records

E. Funke, National Research Council of Canada, Ottawa.

Hydraulics Division

2:30 p.m. Parlor A

Presiding: A. T. Ippen, Chairman, Division's Exec. Committee

Session by Hydraulic Structures Committee

2:30 The Effect of Spur Dikes on Flood Flows through Bridge Constrictions

John B. Herbich, Dept. of Civil Eng., Lehigh Univ.

3:15 Hydraulics of River Flow under Arch Bridges

J. W. Delleur, School of Civil Eng., Purdue Univ.

4:00 Flow through Multi-opening Constrictions

John Shen, U.S. Geological Survey, Washington, D. C.

Structural Division

2:30 p.m. Georgian Room

Presiding: Saul Namyet, Chairman, Division's Technical Program Committee

Presenting a group of short papers on research techniques, with preliminary results of investigations in progress

2:30 Residual Stress and the Compressive Properties of Steel

L. Tall, Fritz Lab.

2:45 Research at Cornell

W. McQuire, Cornell Univ.

3:00 Large Bolted Joints

J. L. Rumpf, Fritz Lab.

3:15 Research on Steel Structures

W. H. Munse, Univ. of Illinois

3:30 Welded Plate Girders

B. Thurlimann and B. T. Yen, Fritz Lab.

3:45 Fatigue Resistance of Prestressed Concrete Members

Robert F. Warner, Lehigh Univ.

4:00 Research on Concrete Structures

C. P. Siess, Univ. of Illinois

4:15 Research at University of Virginia

H. L. Kinnier and J. M. Slepetz, Virginia Council of Highway Investigation and Research

4:30 Research and Development in Structural Steels

T. R. Higgins, Amer. Inst. of Steel Construction

4:45 Research at Alcoa

J. W. Clark, Alcoa Research Labs.

5:00 Plastic Analysis of Latticed Aluminum Bents

C. Marsh, Aluminum Co. of Canada

TOUR, SURVEYING AND MAPPING DIVISION

Friday, Oct. 14

2:30 p.m.

Photogrammetry and Civil Engineering Computer Laboratories at M.I.T.

The program at the laboratories will include a series of demonstrations of photogrammetric instrumentation, data handling equipment, and digital computers applied to surveying, mapping and civil engineering research.

The laboratories are located in Room 1-090 of the main M.I.T. buildings, 33 Massachusetts Ave., Cambridge.

LADIES' ACTIVITIES

Sunday, Oct. 9

2:00 to 5:00 p.m. Registration

3:00 to 5:00 p.m. Tea in Hancock Room Room

To welcome the engineers and their families.

Monday, Oct. 10

9:00 to 11:00 a.m. Get-Acquainted Coffee

In the Hospitality Room

1:30 to 3:30 p.m. Tour of Boston and Cambridge

Museums and educational institutions will be featured on the tour—M.I.T., Harvard, and Boston College.

5:30 to 7:30 p.m. Ice-breaker, Get-Acquainted Party, with cocktails

Admission is by ticket only. Tickets are free with registration.

7:30 p.m. Dinner

This dinner, in the Georgian Room, of the Boston Society of Civil Engineers, will have as speaker the Hon. John F. Collins, Mayor of Boston.

Tuesday, Oct. 11

9:00 to 11:00 a.m. Coffee, Hospitality Room

9:00 a.m. to 4:00 p.m. Tour No. 1

This tour of the North Shore will feature historic and scenic Marblehead and Salem.

10:00 a.m. to 4:00 p.m. Tour No. 2

This tour of the Lexington Battle Green and the Concord Bridge will include lunch at the Wayside Inn in Sudbury.

Wednesday, Oct. 12

9:00 to 11:00 a.m. Coffee, Hospitality Room

10:00 a.m. Award of door prize

This door prize will be from the original paintings of Claude Niki, on exhibit continuously during the week in the Hospitality Room.

12:30 p.m. ASCE Awards Luncheon

The speaker will be Dr. James R. Killian.

6:30 p.m. Reception

7:30 p.m. Formal Dinner Dance in the Grand Ballroom

Thursday, Oct. 13

9:00 to 11:00 a.m. Coffee, Hospitality Room

10:00 a.m. to 12:00 noon. Tour No. 1

This tour of historic Boston will feature the Freedom Trail, Paul Revere House, Old Ironsides and the Old North Church

2:00 p.m. Isabella Stewart Gardner Museum

A gallery talk at 2:00, and a concert at 2:45, will be included.

8:30 a.m. to 5:00 p.m. Tour No. 2

This tour of the South Shore will include Plymouth Fort, Mayflower II and Plymouth Colony.

Evening. An opera or play

Friday, Oct. 14

9:00 to 11:00 a.m. Coffee, Hospitality Room

WEEK-END TOURS

The Ladies' Entertainment Committee will assist individuals or groups in planning tours to view New England autumn foliage on the week end.

ALUMNI REUNIONS

Tuesday, Oct. 11

Cornell University (Cornell Society of Engineers) Dinner Meeting

At Hotel Statler Hilton. Contact Edward F. Arps, 117 Lexington St., Belmont, Mass.

Dartmouth College (Thayer School) Dinner Meeting

At Hotel Statler Hilton. Contact Dean William P. Kimball, Dartmouth College, Hanover, N. H.

University of New Hampshire Dinner Meeting

At Hotel Statler Hilton. Contact Prof. Charles O. Dawson, Univ. of New Hampshire, Durham, N. H.

Thursday, Oct. 13

Manhattan College Dinner Meeting

At University Club, Boston. Contact John F. Molloy, Jr., 94 Hillcrest Ave., Needham 92, Mass.

M.I.T. Dinner Meeting

At M.I.T. Faculty Club. Contact Prof. C. H. Norris, M.I.T., Cambridge 39, Mass.

Northeastern University Dinner Meeting

At Northeastern University. Contact Prof. Charles O. Baird, Jr., Northeastern Univ., Boston 15, Mass.

Purdue University Breakfast

At Hotel Statler Hilton, 7:30 a.m. Contact George W. Fait, 70 Common St., Quincy 69, Mass.

University of Illinois Dinner Meeting

At Hotel Statler Hilton. Contact Ariel A. Thomas, ℅ Metcalf & Eddy, Statler Building, Boston, Mass.

University of Massachusetts Dinner Meeting

At Hotel Statler Hilton. Contact Prof. W. W. Boyer, Univ. of Massachusetts, Amherst, Mass.

Friday, Oct. 14

Norwich University Luncheon

At Hotel Statler Hilton, 12:00 noon. Contact Prof. Gordon Pyper, Norwich Univ., Northfield, Vt.

COMMITTEES

Annual Convention Committee

William H. Mitchell, *General Chairman*
Charles H. Norris, *Vice Chairman*
John Cusack, *Secretary*

Werner Gumpertz, Ernest L. Spencer

Budget and Finance

John H. Hession, *Chairman*

Technical

Emory Ireland, *Chairman*

A. F. Samuel, Gordon Gray, Frank L. Heany, Abraham Woolf

Conditions Of Practice

A. Russell Barnes, *Chairman*

John J. Walsh

Hotel

Cranston R. Rogers, *Chairman*

Walter J. Hickey, John L. Slocum

Exhibits, Attendance Promotion, and Public Relations

Bruce Campbell, *Chairman*

Richard W. Albrecht, William Duffy, Carroll Johnson, Herbert E. Fletcher, Jr., Mark M. Kiley

Field Trips

Paul S. Crandall, *Chairman*

Kenneth M. Childs, Jr.

Students

John L. Lowe, *Chairman*

Robert V. Whitman, Thomas C. Colman, Warren F. Daniell

Luncheons

Roger Williams, *Chairman*

Ladies' Entertainment

Mrs. Arthur T. Ippen, *Chairman*
Mrs. Charles H. Norris, *Ass't. Chairman*
Mrs. Robert G. Dean, *Secretary*
Mrs. Robert W. Hunter, *Treasurer*

Mrs. Arthur R. Barnes, Mrs. Donald R. Harleman, Mrs. Robert M. Jacobs, Mrs. William H. Mitchell, Mrs. Cranston Rogers, Mrs. Howard Simpson, Mrs. Robert A. Snowber, Mrs. Ernest L. Spencer, Mrs. Gordon R. Williams, Mrs. Roger H. Williams, Mrs. Robert V. Whitman.

Entertainment

Robert A. Snowber, *Chairman*

Joseph Lawler, Alfred Pontier, Werner Tikkanen, Robert Anderson, Joseph Lavin, John Gill

Registration

F. T. Sendker, *Chairman*

Alumni

Prof. Ernest L. Spencer, *Chairman*

THE READERS WRITE

Comments on computing composite sections

To THE EDITOR: With great interest I read Hans R. Schaeffer's timely article on "Computing Prestressed Concrete Composite Sections" in the June issue, p. 72. He ably demonstrates how design computations can be greatly simplified by arranging the significant items in tabular form, which not only eliminates a lot of repetitious expressions but also gives the designer a clear picture of the problem.

In connection with my own designs for prestressed concrete structures, I also have made extensive use of tabular forms, which incidentally are very similar to that proposed by Mr. Schaeffer. However, because the operation of multiplying with a constant multiplier on a desk calculator is considerably easier than that of dividing with a constant divisor, it has been found preferable to tabulate the values of 12,000/*S*, instead of *S*/12,000, for computing fiber stresses.

With reference to Mr. Schaeffer's numerical example, I would like to make two comments:

1. In composite structures the ultimate strength of concrete for the precast section is commonly higher than that for the cast-in-place section. The moduli of elasticity for the two sections are also different. Often the effect on the section properties of this difference between the component sections may be significant and cannot be disregarded.

Article 212.4.1 of ACI-ASCE "Tentative Recommendations for Prestressed Concrete" explicitly calls for a consideration of the transformed section based on the modular ratio. If f'_c of 3,000 psi and E of 3,000,000 psi are assumed for the cast-in-place concrete, and f'_c of 5,000 psi and E of 4,300,000 psi for the precast concrete, the transformed area of the cast-in-place section would be only 3.0/4.3, or 70 percent of the actual area. The composite section moduli would be smaller and the corresponding fiber stresses would be proportionally greater than those shown in the table.

2. Under the combined action of the weight of the girder and the initial prestress corresponding to a final prestress of 560 kips, the initial fiber stresses, as given by Mr. Schaeffer, are 343 psi (tension) and 3,096 psi (compression). The temporary tension of 343 psi may be permitted if a sufficient amount of nonprestressing steel is provided to take care of the total tension. The temporary compression of 3,096 psi, however, would be subject to question.

In common practice, the maximum compressive fiber stress for post-tensioned members is limited to 55 percent of the compressive strength of concrete at the time when the prestress is transferred. If 4,000 psi is specified as the concrete strength at transfer, the maximum permissible compressive fiber stress is only 0.55 x 4,000, or 2,200 psi. The tabulated compressive stress of 3,096 psi would require a compressive strength of the concrete at transfer of 5,630 psi, and an even higher value at 28 days. This would seem uneconomical.

KENNETH DIAO, M. ASCE
Structural Engineer
Madigan-Hyland

Long Island City, N. Y.

M-m tables valuable for deflection calculations

To the Editor: Orchids to H. H. Fickel for his "M-m Tables for Deflection Calculations," in the June issue, p. 70. Similar tables from *Taschenbuch Für Bauingenieure* became part of the structural design standards of Albert Kahn's office in Detroit in the 1930's. We have used them ever since.

It is a shame that many leading professors and other engineers in the field of structural engineering are not aware of the availability of these tables. They still struggle with the simple Hardy Cross method, pitching full moments and catching half moments from post to post.

As a practicing structural engineer for the past 35 years, I am sure that if these tables were properly publicized, the new Hardy Cross methods would definitely be replaced by the "antiquated" and "good" old theorem of least work. I do hope that the teachers of structures will use the tables to show the young structural engineers how easy it really is to figure deflections and moments for rigid frames.

Abraham Woolf, F. ASCE
President, Abraham Woolf & Associates, Inc.

Boston Mass.

Sagging of roofs causes corners to rise

To the Editor: Captain Roberts's very interesting article on "adverse weather" in the June issue, p. 35, raises many points for discussion, and suggests fruitful fields for study.

Under the heading of "Vertical and Horizontal Surface Cracking of Concrete-Block Structures," he mentions a phenomenon that I have frequently observed, namely the lifting of the corners of concrete roof slabs supported on masonry walls.

I do not believe this phenomenon has anything to do with differential shrinkage of the concrete, but is merely a demonstration of the old law that there is no stress without strain. The roof, even in supporting only its own weight, must sag in the center, or dish, and since the midpoints of the sides are supported, the corners must go up. I know of many examples, and was constrained to stare at one across my desk here in Ottawa for two years.

When I first became aware of this phenomenon I started to figure out ways of holding down the corners, but soberer thoughts later prevailed. I now advise a short strip of tar paper along the top of the masonry running away from each corner, and the application of a calking gun to the crack as soon as it appears, as it always will. If you can't fight 'em, join 'em.

I look forward to reading the rest of Captain Roberts' articles.

Douglas S. Laidlaw, M. ASCE
Project Engineer
Air Force Headquarters

Ottawa, Canada

Deflections found by conjugate-beam method

To the Editor: H. H. Fickel has done the engineering profession a service in taking time to present the M-m tables for deflection calculations in the June 1960 issue, p. 70.

For those who have few occasions to make deflection calculations of rigid frames, another easily remembered method is that of the conjugate beam. Applying this method to Fig. 1 (*a*) of Mr. Fickel's article, and taking moments of the conjugate beam about Point 2, we have the situation shown in the accompanying Fig. 1.

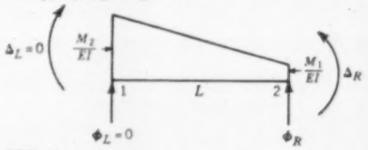


FIG. 1.

$$\Delta_R = \frac{1}{\mathrm{EI}}\left[\left(\frac{M_2 - M_1}{2} L \frac{2}{3} L\right) + \frac{M_1 L^2}{2}\right] \quad (1)$$

$$EI\ \Delta_R = \frac{L^2}{6}\left(2 M_2 + M_1\right) \quad . \quad . \quad (2)$$

The numerical values from Mr. Fickel's article are $M_1 = 9.2$; $M_2 = 75.2$; and $L =$ 20 ft. Substitution in the above equation gives:

$$EI\ \Delta_R = \frac{20^2}{6}\left[2\ (75.2)\ + 9.2\right] = 10{,}640$$

which is the deflection as given in Mr. Fickel's article.

R. C. Lofgren, A.M. ASCE
Supervising Engr., R. W. Beck and Associates

Seattle, Wash.

Private consultants widely used by Corps of Engineers

To the Editor: I have just read your June 1960 issue and wish to thank you for the complimentary note on my two-year extension as Chief of Engineers in the "By-Line Washington" column (p. 108).

However, I would like to correct some statistical data on construction attributed to me in this same column in regard to my testimony before the House Committee on Science and Astronautics.

The statement (top of right column) that "94 percent of its [the Corps of Engineers'] total engineering work—including both military construction and civil works—is done by its own staff" is incorrect. Page 18 of the testimony records my statement as follows: ". . . during fiscal year 1959 94.1 percent by dollar value of all the Corps of Engineers' construction contracts, involving military construction for the Army and for the Air Force, were awarded by open competitive bidding."

The statement that "the Corps spends a little over 5 percent of its money for all engineering design, supervision and overhead" is also incorrect. My testimony in this area was that an average of 89 percent of construction funds made available to the Corps go into actual construction contracts and that the remainder (11 percent) is taken up by design, supervision, inspection and overhead. Supervision, inspection and overhead average 6.8 percent, with design costs making up the difference. Reference to page 19 of the Hearing testimony will confirm this.

As you know, the Corps of Engineers uses architect-engineers for special designs and to supplement our in-house capability whenever the work load necessitates such action. Contract payments to private firms for architect and engineer services in fiscal 1959 amounted to $48 million; for the 3 years 1957-1959, comparable costs averaged $45 million a year; for the 5 years 1955-1959, the average was $43 million a year. Thus, during the past five fiscal years, the Corps of Engineers has used consulting firms to design an average of $1.3 billion of construction each year, an aggregate of $6.5 billion for the five-year period.

Correction of this statistical data in Civil Engineering will be appreciated.

E. C. Itschner, F. ASCE
Lt. Gen., USA
Chief of Engineers

Washington, D.C.

News hard to find

To the Editor: The comments of Mr. Leggett in "The Readers Write" columns of the June issue, p. 73, reflect exactly my feelings on the new format of the magazine in which the news pages are intermingled with the technical articles.

With this arrangement, it is difficult enough to find, on first reading, all the technical articles or all the ASCE news. But what is worse, it is practically impossible to locate quickly a piece of information in a back issue. As a consequence, it appears to me that the usefulness of the magazine has been seriously impaired.

Steven J. Fenves, A.M. ASCE
Instructor in Civil Engineering
University of Illinois

Urbana, Ill.

Accuracy of transits in mils

To the Editor: In his article, "Surveying Instruments in Mils," in the June issue, p. 59, John J. Durkin quotes Prof. Philip Kissam, F. ASCE, as follows:

"1 mil = 1/1,000 radian to an accuracy of better than 1 part in 500."

The approximation is not quite that good. It is 1 part in 50.

$$\sin 1\ \mathrm{mil} = \pi/3{,}200 = 0.0009817$$

R. P. Spiro, A.M. ASCE

New York, N. Y.

Editor's Note: *Professor Kissam and John J. Durkin have concurred in the correctness of Mr. Spiro's observation.*

AMERICAN SOCIETY OF CIVIL ENGINEERS

Second National Conference on Electronic Computation

Co-Sponsors, Committee on Electronic Computation, ASCE Structural Division, and the Pittsburgh Section, ASCE

Pittsburgh Hilton—Gateway Center, Pittsburgh, Pa. **September 7-9, 1960**

ADVANCE REGISTRATION REQUESTED

So that the committee may better serve you, please use the coupon on page 152 to register and reserve your luncheon tickets in advance. Should your plans change later, refund will be made on request. Registration is $5.00 (free to wives accompanying their husbands). Fee includes tickets for computer seminars and reception. Luncheon tickets are $4.25 each. (Reduced rates will prevail for undergraduate students).

Make checks payable to D. E. Oelschlager, Finance Chairman. Send coupon and check to: Charles A. Keelen, Registration Chairman, Portland Cement Association, 2437 Koppers Building, Pittsburgh 19, Penna.

With or without advance registration, please check in at the registration desk as early as possible, and in any event before attending your first session. The registration desk will open at 3:00 p.m., Wednesday, September 7.

HOTEL ACCOMMODATIONS

Each individual is responsible for his own hotel reservation. The Pittsburgh Hilton is the official conference hotel; all program events will be held there on the ballroom floor. A limited number of rooms are available to those conference participants who make their reservations early. Use the coupon on page 150 to reserve your room or suite, and avoid disappointment in September.

SPEAKERS' BREAKFASTS

7:30 a.m. **The Chartiers, Suite A**

By invitation only, speakers' breakfasts will be held on Thursday and Friday mornings.

COMPUTER DEMONSTRATION

The computer demonstration will be the most outstanding ever presented at a civil engineering meeting and will include items of new equipment having their first public exhibition. Among the companies participating are Friden, International Business Machines, National Cash Register and Bendix. Informative seminars, presented by the same manufacturers, will be of value to all engineers.

COMPUTER SEMINAR

Wednesday, Sept. 7

8:00 p.m. **Ballroom No. 2**

Computer seminar presented by the computer demonstrators.

THURSDAY MORNING

SEPT. 8

General Session

9:00 a.m. **Ballroom No. 1**

Presiding: Nathan M. Newmark, Chairman, Committee on Electronic Computation, Structural Division

Greeting

Wilfred Bauknight, Chairman, Pittsburgh Section Committee, Conference on Electronic Computation.

Remarks

Nathan M. Newmark, Chairman, Committee on Electronic Computation, Structural Division.

Keynote Address: Impact of Electronic Computation on Civil Engineers

George S. Richardson, Senior Partner, Richardson, Gordon & Associates, Pittsburgh, Penna.

Session A—Ballroom No. 2

10:30 a.m.

Presiding: R. D. Dewell, Chairman, Exec. Committee, Structural Division

10:30 Computer Program Exchange: Myth and Reality

J. C. L. Chang, Chief Design Engr., Richardson, Gordon & Associates, Pittsburgh, Penna.

11:10 Computer Design of Structural Steel for Buildings

M. Zar, Associate, and C. Beck, Design Engr., Sargent & Lundy, Engineers, Chicago, Ill.

Session A—Ballroom No. 3

10:30 a.m.

Presiding: James Michalos, Chairman, Task Committee on Program Interchange, Committee on Electronic Computation, Structural Division

10:30 Computer Solutions to Linear Buckling Problems

R. J. Sylvester, Asst. Research Scientist, The Martin Co., Denver, Colo.

11:10 Error Analysis for Eigenvalue Problems

R. B. McCalley, Jr., Consulting Engr., Knolls Atomic Power Lab., General Electric Co., Schenectady, N. Y.

Session A—Ballroom No. 4

10:30 a.m.

Presiding: N. D. Whitman, Jr., Member, Exec. Committee, Structural Division

10:30 Optimum Design of Transmission Towers

G. P. Anaston, Blaw-Knox Equipment Div., Blaw-Knox Co., Pittsburgh, Penna.

11:10 **Optimum Design of Reinforced Concrete Buildings**

J. D. Graham, Consulting Civil Engr., KCS Ltd., Toronto, Ontario, Canada.

GENERAL LUNCHEON

Thursday, Sept. 8

12:15 p.m. Ballroom No. 1

Presiding: Michael A. Gross, President, Pittsburgh Section, ASCE

Luncheon Address: A Vision of Our Automatic Future

Neal J. Dean, Partner, Booz, Allen & Hamilton, Chicago, Ill.

THURSDAY AFTERNOON

SEPT. 8

Session B—Ballroom No. 2

2:20 p.m.

Presiding: Jackson L. Durkee, Chairman, Task Committee on Conferences, Committee on Electronic Computation, Structural Division

2:20 **Computer Analysis of Structures**

J. F. Borges, Head, Structural Studies Sect., Laboratorio Nacional de Engenharia Civil, Lisbon, Portugal.

3:00 **Structural Idealization for Digital Computer Analysis**

J. S. Archer and C. H. Samson, Jr., Project Structures Engineers, Convair, Fort Worth, Tex.

3:40 **Structural Design by Systematic Synthesis**

L. A. Schmit, Jr., Asst. Prof. of Structures, Case Inst. of Tech., Cleveland, Ohio.

4:20 **Simultaneous Equations Solved by Over-Relaxation**

F. G. Lehman, Assoc. Prof. in Civil Eng., Newark College of Eng., Newark, N. J.

Session B—Ballroom No. 3

2:20 p.m.

Presiding: F. A. Reickert, Vice Chairman, Task Committee on Program Directory and Library, Committee on Electronic Computation, Structural Division

2:20 **The Electronic Computer as a Tool in Moment Distribution**

J. E. Soehrens, Staff Consultant, C. F. Braun & Co., Alhambra, Calif.

3:00 **Multi-Story Frame Analysis by Digital Computer**

M. F. Rubenstein, Engr., Victor Gruen Associates, Los Angeles, Calif.

3:40 **Stiffness Method of Rigid-Frame Analysis**

M. L. Pei, Assoc. Prof. of Civil Eng., The City College, New York, N. Y.

4:20 **Computing Maximums Due to Moving Loads**

J. N. Lingeman, Engr., Hazelet & Erdal, Chicago, Ill.

Session B—Ballroom No. 4

2:20 p.m.

Presiding: G. V. Berg, Chairman, Task Committee on Mathematical Methods, Committee on Electronic Computation, Structural Division

2:20 **Some Basic Concepts in Matrix Structural Analysis**

F. R. Berman, Consulting Engr., Huntington, N. Y.

3:00 **The Elements of Matrix Structural Analysis**

S. Shore, Prof. of Civil Eng., Univ. of Pennsylvania, Philadelphia, Penna.

3:40 **Dynamic Analysis of Circular Arches**

R. T. Eppink, Research Associate, and A. S. Veletsos, Prof. of Civil Eng., Univ. of Illinois, Urbana, Ill.

4:20 **A Numerical Procedure for the Analysis of Continuous Plates**

A. H.-S. Ang, Asst. Prof. of Civil Eng., and N. M. Newmark, Head, Dept. of Civil Eng., Univ. of Illinois, Urbana, Ill.

RECEPTION

Thursday, Sept. 8

5:30 p.m. Ballroom No. 1

For this reception, the Pittsburgh Section is host.

COMPUTER SEMINAR

Thursday, Sept. 8

8:00 p.m. Ballroom No. 2

This computer seminar is presented by the computer demonstrators.

FRIDAY MORNING

SEPT. 9

Session C—Ballroom No. 2

9:00 a.m.

Presiding: E. K. Timby, Director, ASCE

9:00 **Sloping Surcharge Retaining-Wall Design**

M. A. Wadsworth, Computing Engr., Gannett, Fleming, Corddry & Carpenter, Harrisburg, Penna.

9:40 **Vessel Foundation Designs Using a Digital Computer**

L. G. Horton, Head, Civil Eng. Dept., and E. S. Eichmann, Eng. Analyst, C. F. Braun & Co., Alhambra, Calif.

10:20 **Stress Distribution Patterns and Settlement Characteristics of Structural Pile Foundations**

E. P. Rausa, Soils Engr., Howard, Needles, Tammen & Bergendoff, New York, N. Y.

11:00 **Numerical Analysis of Laterally Loaded Piles**

L. C. Reese and H. Matlock, Assoc. Professors of Civil Eng., Univ. of Texas, Austin, Tex.

Session C—Ballrooms Nos. 3 and 4

9:00 a.m.

Presiding: Sidney Shore, Chairman, Task Committee on Programming and Coding, Committee on Electronic Computation, Structural Division

9:00 **A Computational Technique for Three-Dimensional Pin-Jointed Structures**

C. E. Pearson, Eng. Div., Arthur D. Little, Inc., Cambridge, Mass.

9:40 **The Finite-Element Method in Plane Stress Analysis**

R. W. Clough, Prof. of Civil Eng., Univ. of California, Berkeley, Calif.

10:20 **Numerical Analysis Applied to Beam Vibrations**

E. N. Wilson, Asst. Prof. of Civil Eng., New York Univ., New York, N. Y.

11:00 **Inversion of Band Matrices**

S. O. Asplund, Prof. of Structural Mechanics, Chalmers Univ. of Technology, Gothenburg, Sweden.

GENERAL LUNCHEON

Friday, Sept. 9

12:00 noon **Ballroom No. 1**

Presiding: CARL B. JANSEN, President, Dravo Corp., Pittsburgh, Penna.

Luncheon Address: The Use of Computers in Election Forecasting

LEON NEMEREVER, President, Computer Operations, Inc., Garden City, N. Y.

FRIDAY AFTERNOON SEPT. 9

Session D—Ballroom No. 2

2:00 p.m.

Presiding:* *E. H. King, Chairman, Task Committee on Educational Aspects, Committee on Electronic Computation, Structural Division

2:00 Computer Analyses of Twin Box Culverts

J. S. HOFFMAN, Programming Engr., Iowa State Highway Commission, Ames, Iowa.

2:40 Computer Analysis of a Pier with Unlimited Shape

A. R. BARKOCY, Head, Computer Dept., Vogt, Ivers, Seaman and Associates, Cincinnati, Ohio.

3:20 Computer Design of Prestressed Concrete Beams for Deflection Control

FELIX KULKA, Associate, T. Y. Lin and Associates, Van Nuys, Calif.

Session D—Ballrooms Nos. 3 and 4

2:00 p.m.

Presiding:* *C. W. Zahler, Chairman, Task Committee on Statistical Applications, Committee on Electronic Computation, Structural Division

2:00 Computer Methods for Dynamic Structural Response

V. H. NEUBERT, Supervisor, Mech. of Solids Group, Applied Mech. Sect., Electric Boat Div., General Dynamics, Groton, Conn.

2:40 Matrix Analysis of Non-Linear Structures

E. L. WILSON, Graduate Student, Univ. of California, Berkeley, Calif.

3:20 New Methods of Matrix Structural Analysis

B. KLEIN, Chief of Structures, Solar Aircraft Co., San Diego, and M. CHIRICO, Senior Research Engr., Comp. Lab., Convair-Astronautics, San Diego, Calif.

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Nathan D. Whitman, Jr., *Contact Member, Executive Committee*

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Mrs. Wilfred Bauknight, *Ladies' Activities*

ENGINEERS' NOTEBOOK

Open-air tube in tank solves many problems

JOSEPH C. KENT, M. ASCE, Assistant Professor of Civil Engineering, University of Washington, Seattle, Wash.

When liquid is being discharged from a tank, the liquid level drops continuously, and the head and quantity change accordingly. If a constant head and a constant quantity are desired, a tank with an overflow is normally required. To eliminate the need for an overflow, an open tube can be inserted through the sealed top of the tank. Air then can enter the tank only through the tube.

The bottom of the air tube, El. *A* in Fig. 1, represents atmospheric pressure. The head *H* is measured between El. *A* and the discharge opening below. As long as the liquid level remains above El. *A*, the head remains constant.

The constant head in the tank can be changed easily without changing the liquid level. If the open-air tube is raised or lowered, the head *H* on the tank will gradually rise or drop the corresponding amount. Thus, with allowance for a brief time lag, the head on the tank will always be represented by the distance *H* between the point of discharge and the bottom of the open-air tube.

This apparatus has a great variety of applications, among which are:

1. The constant-head requirement can be found for determining the permeability of a substance.
2. The constant flow rate, Q, can be determined by the drop in the water surface, net area of tank, and time.
3. For calibration purposes, the desired velocity can be obtained and maintained by a proper setting of the tube.
4. Jet velocity as a function of head can be demonstrated in the classroom. The head can be increased or decreased simply by raising or lowering the open-air tube.

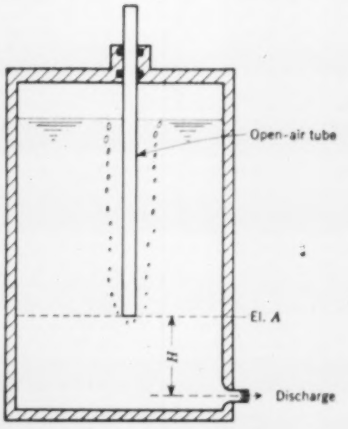
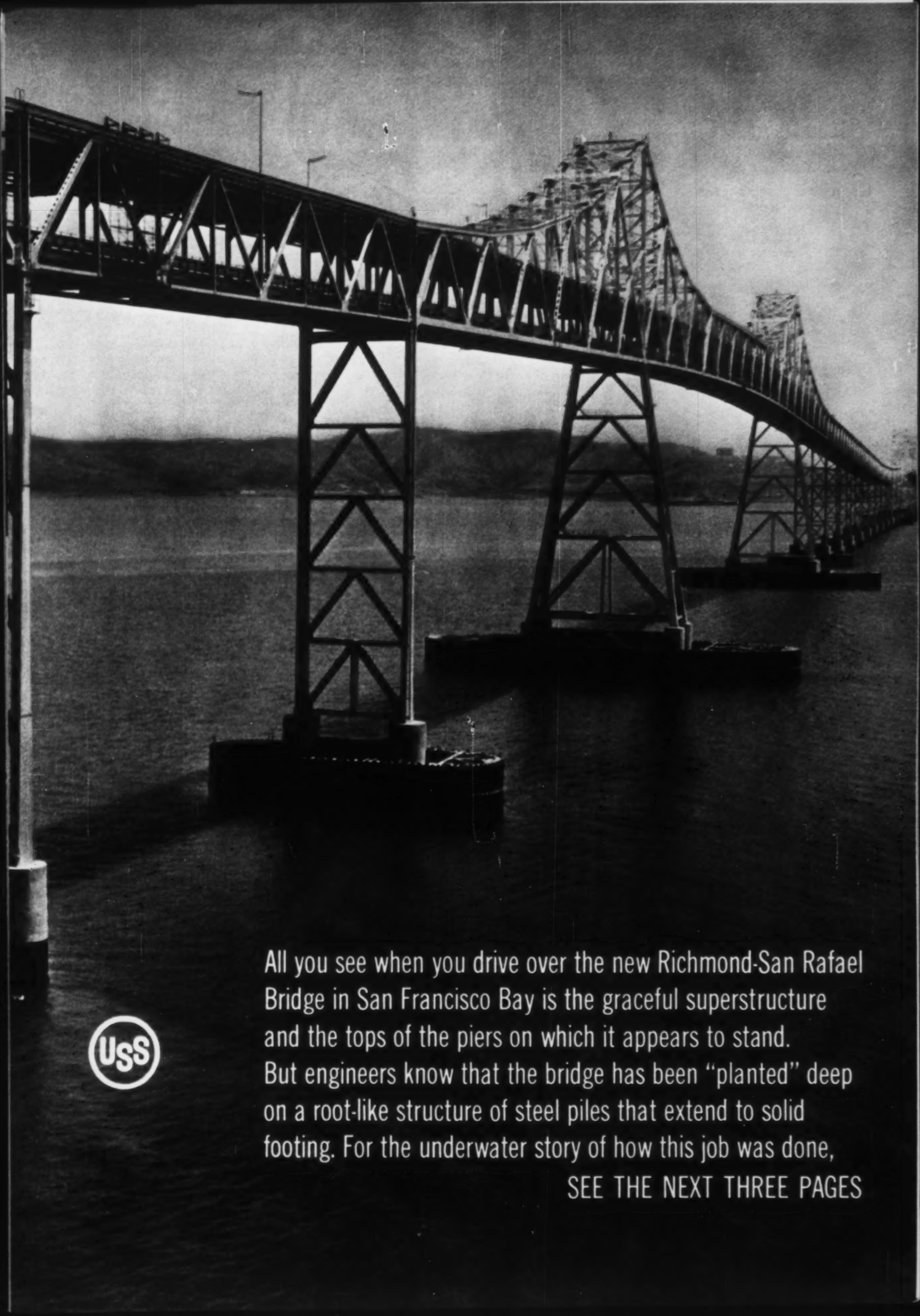


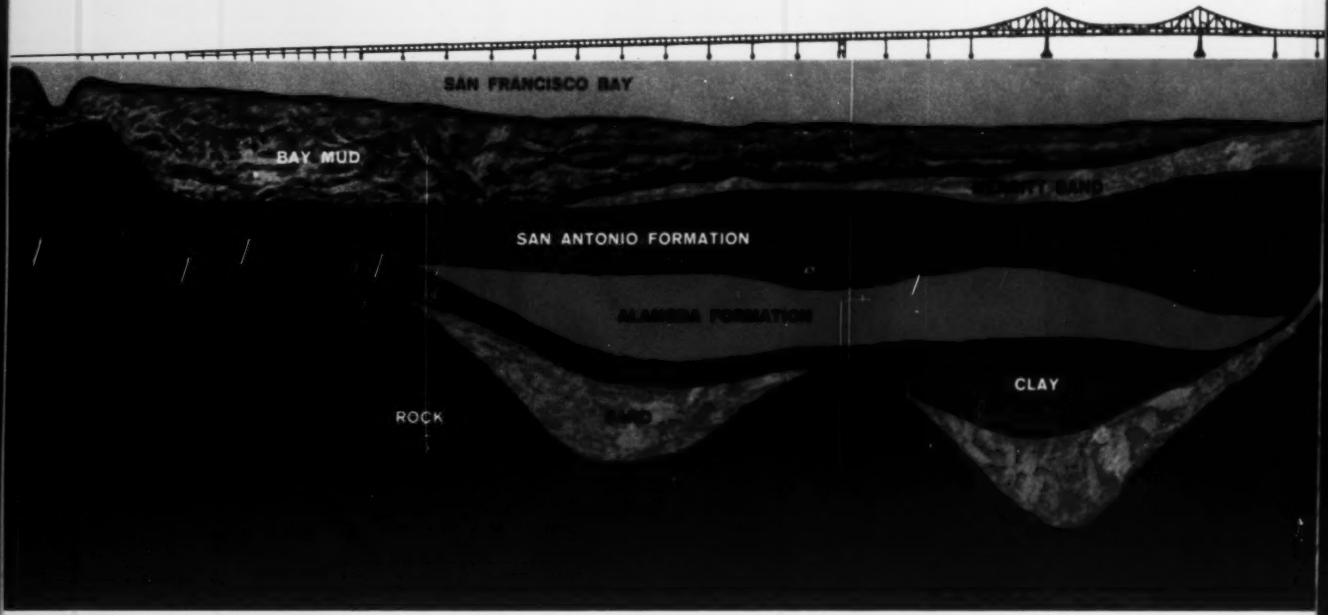
FIG. 1. Tank with open-air tube maintains a constant head.



All you see when you drive over the new Richmond-San Rafael Bridge in San Francisco Bay is the graceful superstructure and the tops of the piers on which it appears to stand. But engineers know that the bridge has been "planted" deep on a root-like structure of steel piles that extend to solid footing. For the underwater story of how this job was done,

SEE THE NEXT THREE PAGES

Richmond-San Rafael Bridge over San Francisco Bay—length 21,345 feet. Lower sketch shows stratification encountered and points up need for extra long piles. This bridge was built for the State of California, Department of Public Works, Division of San Francisco Bay Toll Crossings. Substructure General Contractor: Ben C. Gerwick, Inc., and Peter Kiewit Sons Company.



Problem: How to put the Richmond-
Solution: USS H-Piles under novel

The Richmond-San Rafael Bridge, just north of San Francisco, is one of the world's longest. It stretches across the bay for 21,345 feet. This makes it longer than the Mackinac Bridge and only 1,377 feet shorter than the San Francisco-Oakland Bay Bridge. The new bridge has two decks, each carrying three lanes of traffic across San Francisco Bay between Richmond and San Rafael, California.

Tests on soil samples indicated proposed loads on displacement-type piles would probably result in excessive settlement. It was decided that piles had to be driven to rock or into a deep sand-gravel stratum.

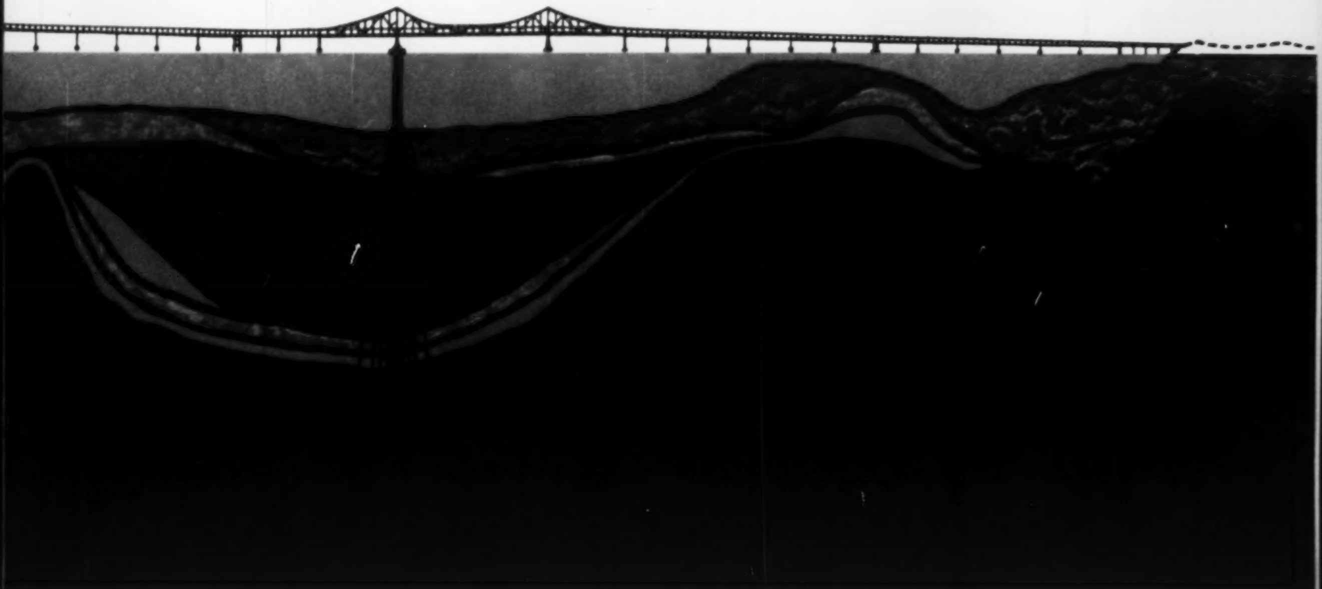
Studies indicated that steel H-piles were the logical choice because:

1. H-piles were more suitable for penetrating the deep overburden in order to reach suitable strata for end bearing.
2. H-piles provided utmost flexibility of final lengths—they could be easily cut or spliced.
3. Their ruggedness made for easy handling.
4. Their strength permitted heavy loads per pile.
5. They were readily available.

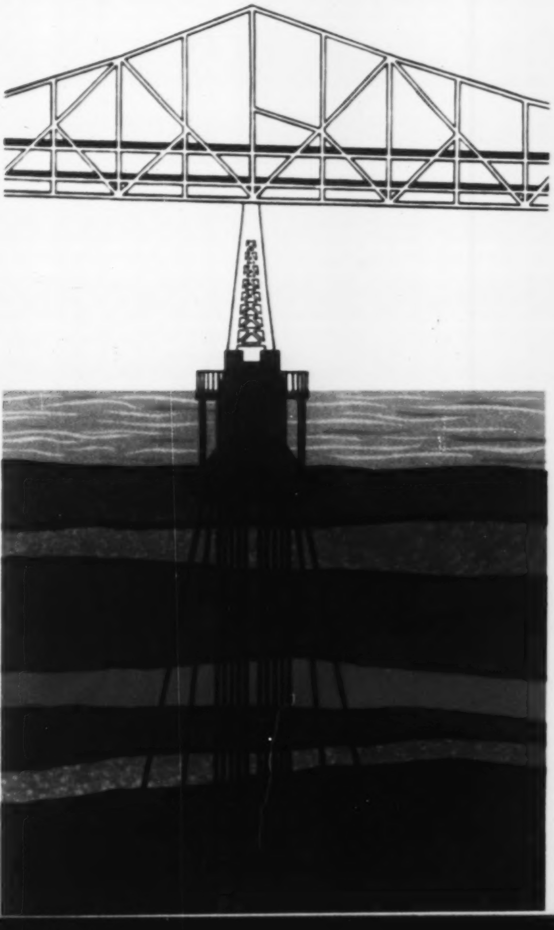
Precast bell-type piers were selected for the deep water portion of the job. These had proved economical for pile-supported piers in moderately deep water on previous major bridge jobs. At each bell-pier location, several steel H-piles were driven to position a precast concrete base grid which was later incorporated in the pier foundation. The base grid contained slots designed to act as guides for the remaining 14-inch, 89-pound steel H-piles. These were later grouted into the base grid which then served as the base for the precast bell sections set on top. After pouring a tremie seal inside the bells, the rest of the concrete was placed in the dry. These base grids were 12 to 56 feet below water so that the contractor had to provide for underwater driving of piles. This was done with rigs especially designed for the job to provide telescoping leads to support the hammer as deep as 56 feet under water and the pile head as much as 110 feet above the water.

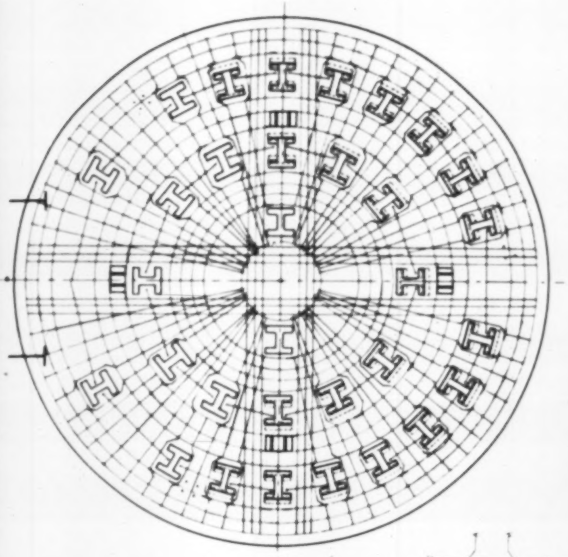
There were 62 bell-type piers constructed. In addition, 8 cofferdam-type piers and 9 dry-land piers also utilized steel H-piles. The 79 piers are supported by 5,047 14-inch, 89-pound steel H-piles ranging in length from 30 to 175 feet—a total of 585,700 lineal feet, or about 25,000 tons, approximately half of which were supplied by United States Steel.

For information on any type of steel piling—steel H-piles, sheet piling or steel pipe piling, write to any of our district offices or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



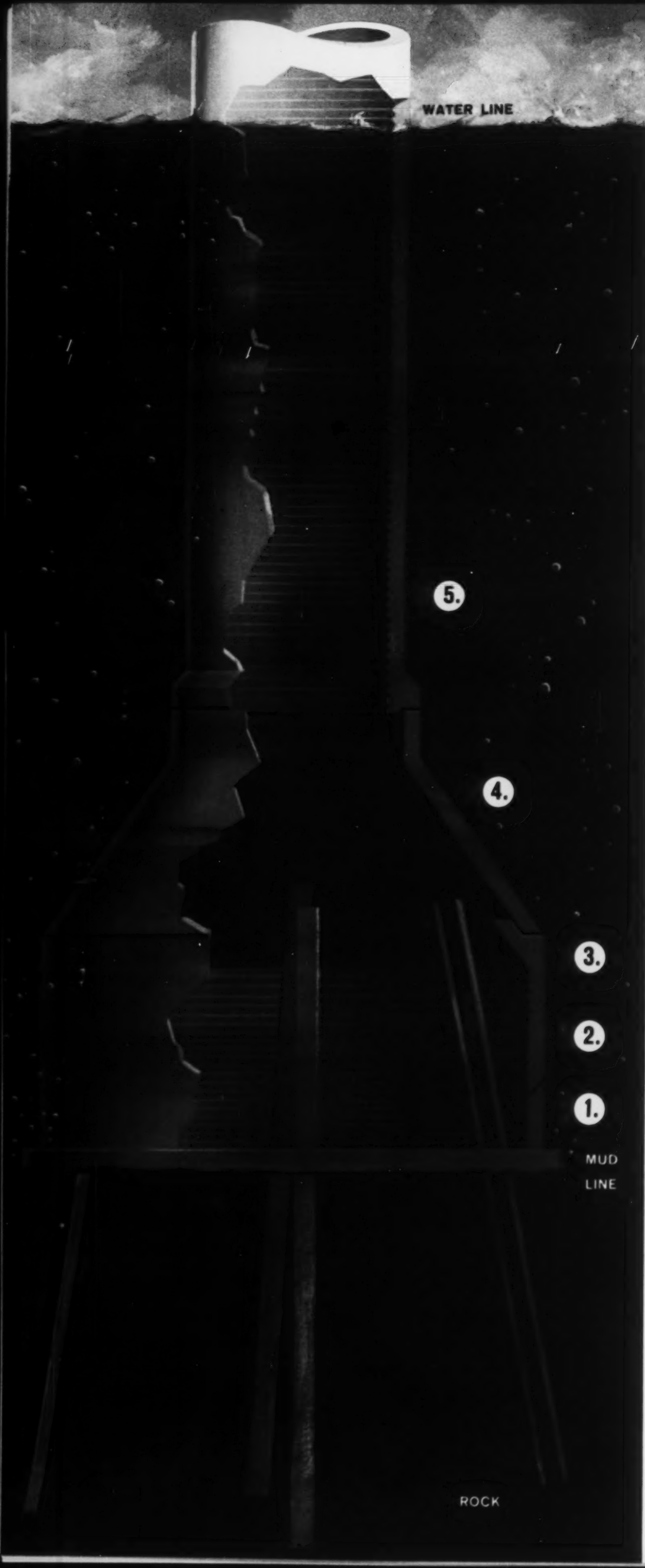
San Rafael Bridge across these holes... bell-type piers





Base grid for bell-type pier showing slots for locating piling. Batter piles indicated by dotted lines and shown in detail on small drawing.

TURN PAGE



how the bell-type piers were constructed underwater

1. At each pier location, concrete base grids containing slots to guide the steel H-piles were lowered through the water to exact position. Some were as deep as 56 feet.

2. Several steel H-piles were driven to hold each base grid in exact position. The remaining piles were then driven and the base grids were later incorporated in the pier foundation. Where necessary, pile tops were cut off underwater by divers.

3. Cylindrical precast bell sections were lowered through the water and positioned on top of each base grid. A special seal made the joints watertight.

4. Cone-shaped precast concrete or steel sections with a seal on top and bottom were then placed on top of the cylindrical sections.

5. Precast shaft extending above water. After pouring a tremie concrete seal inside the bells, the rest of the concrete was placed in the dry.

For the main piers using four interconnected bells and for some of the two-bell piers, special steel forms were used instead of precast concrete bells.

USS is a registered trademark

United States Steel Corporation – Pittsburgh
Columbia-Geneva Steel – San Francisco
National Tube–Pittsburgh
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Export Company
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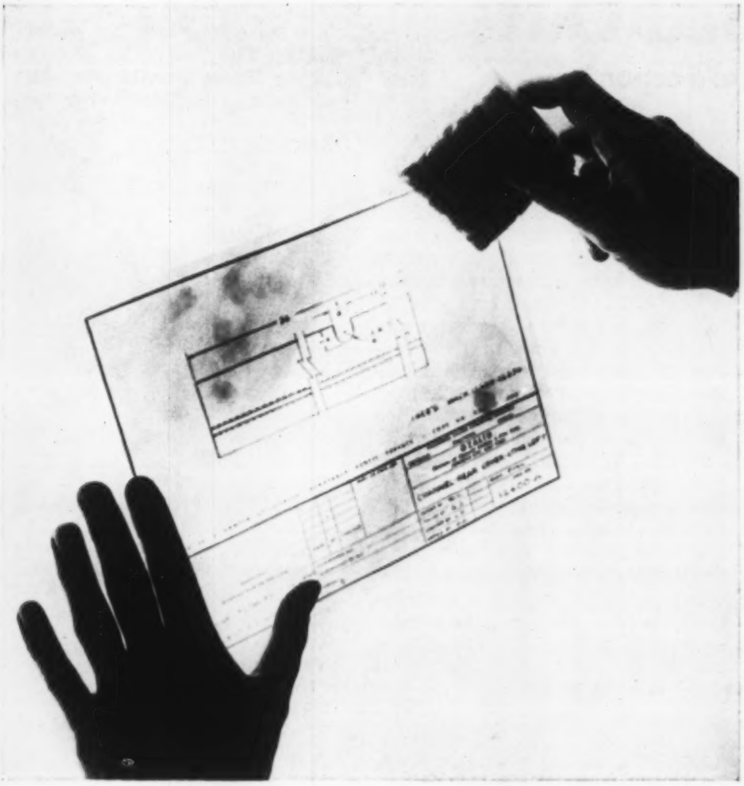
OZALID *NEWSLETTER*

NEW IDEAS TO HELP YOU WITH ENGINEERING REPRODUCTION AND DRAFTING



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Ozalid, *Johnson City, New York. A Division of General Aniline & Film Corp.*

ASCE NEWS

UEC Topped Out!

Has your Local Section?

Topping out for the United Engineering Center took place late in July—just three months after the first piece of steel was set into place on the United Nations Plaza site.

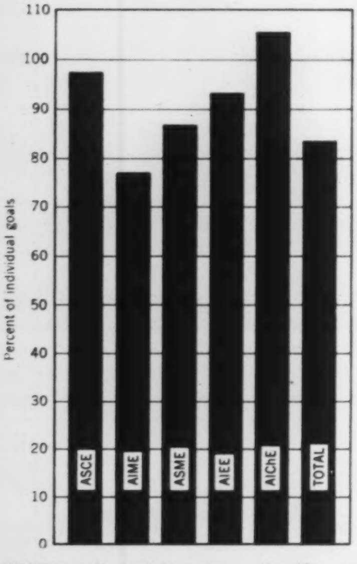
Nearly a month ahead of schedule, work on the new building, which will house some eighteen engineering societies, has progressed to the symbolic flag-raising ceremony—marking the high point for the erected steel. (Pictures next month.) Down below, work is advancing rapidly—progress being marked by the installation of plumbing equipment and electrical wiring. Placing the concrete floors has progressed to the thirteenth floor level and work on the stainless steel-glass-limestone exterior started late in July, according to the Turner Construction Company, general contractor for the building.

Emphasis is still being put on the UEC fund drive in many ASCE Local Sections. With the enthusiastic cooperation of all, "topping out" of the fund drive can be reported in the September issue of Civil Engineering.

With less than $16,000 to go, there can be no relaxing now. Recent returns show a definite increase in contributions of $50 to $500 and even some up to $1,000. Just a few of the larger subscriptions of this kind, with the support of many smaller ones, will help many Local Sections to go over the top.

Texas has placed on the Honor Roll as No. 38 to go over the top with Cleveland, Tacoma, Buffalo and Montana close to their goals. Other star performers are the Los Angeles, National Capital, Oregon, Seattle, Wyoming and Intermountain local sections. A dozen more are making steady gains.

If you haven't made your contribution yet—or if you can make another—DO IT NOW. Your contribution may be *the* one to push ASCE over the top in the Member Gift Drive.



ASCE member-giving passes the 98 percent mark. Soon ASCE will enjoy 100 percent success with AIChE who went over the top several months ago.

How about your pledge?

- •• Just make out a check to United Engineering Trustees and mail it to Society Headquarters.
- •• The staff will handle details—see that the pledge is properly credited to your section.
- •• Formal acknowledgment will be made directly to you in the form of a receipt from U.E.T.
- •• The receipt can then be used to support your income tax deduction.

Let's finish the job—this month!

Total Membership as of July 8, 1960

Fellows	11,086
Members	16,133
Associate Members	18,442
Affiliates	101
Honorary Members	48
Total	45,810
(July 9, 1959	43,066)

UEC HONOR ROLL

There are 38 Sections on the UEC Honor Roll, with Texas the newcomer to the list. Several others are so near their goals that they may well have attained Honor Roll status by the time the August issue has reached its readers. The praiseworthy 38 currently on the Honor Roll are listed here in the order of meeting their quotas.

Kentucky (122)
Lehigh Valley (138)
Nashville (102)
Cincinnati (141)
Columbia (135)
Philadelphia (152)
Hawaii (129)
Rochester (123)
Ithaca (142)
Southern Idaho (200)
Indiana (140)
Delaware (110)
Kansas City (119)
Central Pennsylvania (111)
Arizona (110)
West Virginia (140)
Central Ohio (107)
Tri-City (116)
Puerto Rico (117)
Wisconsin (106)
Georgia (110)
Maryland (109)
Tennessee Valley (107)
Metropolitan (118)
Connecticut (110)
Maine (103)
Rhode Island (101)
Alaska (107)
Central Illinois (108)
Syracuse (109)
Illinois (103)
Nebraska (106)
Iowa (105)
Duluth (100)
Virginia (101)
San Francisco (101)
Spokane (101)
Texas (100)

Total Amounts Necessary to Meet Local Section Quotas

Local Section	Remaining Quota	Local Section	Remaining Quota
Cleveland	$ 45	North Carolina	$1,739
Tacoma	149	Louisiana	1,750
Buffalo	166	Brazil	1,795
Montana	185	New Mexico	1,830
Panama	260	Republic of Colombia	1,970
Massachusetts	396	Venezuelan	2,183
Intermountain	662	South Carolina	2,192
Mexico	675	Sacramento	2,332
New Hampshire	687	San Diego	2,717
Mid-Missouri	819	Pittsburgh	2,923
South Dakota	841	Alabama	3,838
Wyoming	885	Northwestern	3,999
Akron	1,017	Mid-South	4,119
Dayton	1,024	Oregon	4,243
Toledo	1,072	Los Angeles	5,586
Oklahoma	1,076	Florida	7,244
Seattle	1,236	Colorado	8,292
St. Louis	1,438	National Capital	8,880
Kansas	1,504	Michigan	9,260
Mohawk-Hudson	1,587		
Miami	1,720		

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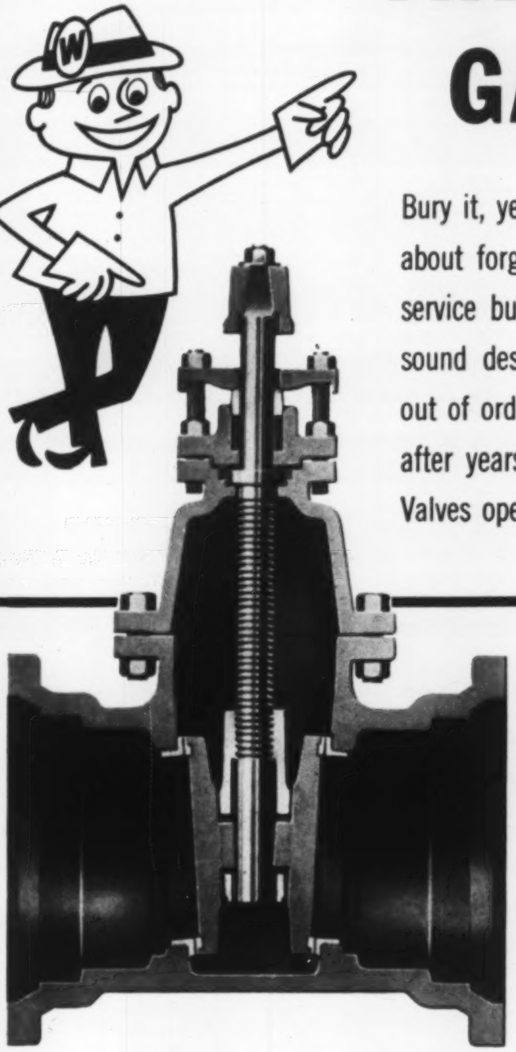

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Hilf
Hvorslev
Turnbull
Peck
Casagrande
Barron

All members of Shear Strength Conference Committee are conveniently identified for the photographer. Mr. Turnbull was committee chairman, and Mr. Hilf secretary.

Shear Strength Conference Reveals Strength of the Art

In the early stages of planning for the Research Conference on Shear Strength of Cohesive Soils, there was some talk of inviting only a few who "knew their way around" in this subject area, for a serious discussion of the status of knowledge in this highly specialized field. However, the number of "experts" turned out to be somewhat larger than was originally contemplated. More than 700 indicated their interest, and at least some degree of knowledge in this highly complicated field, to the extent of traveling to Boulder, Colo., for a week's discussion and swapping of information. Sessions were held June 13 through 17, at the University of Colorado. The hosts were the university and the Colorado Section of ASCE, with the Soil Mechanics and Foundations Division arranging and conducting the conference.

While it is presumptive to draw a simple conclusion from such a complex mass of information, one such general impression was inescapable. With all the work that has been done, and all the observed data that have been correlated, it is still essential, when determining foundation conditions, to have a competent and experienced engineer interpret the theoretical analysis and laboratory testing. There are so many variables involved in these studies that the inexperienced person can be led astray very easily by his computer, or by his laboratory results. In his summation for one of the panels, Dr. Ralph Peck stated this another way: That a clear demonstration of the growing maturity of the practice in this special field is the recognition that certain things are not known. "Professional judgment must bridge the gap where knowledge is lacking."

Conference Proceedings to Be Available

The very extensive information which is available in the field of shear strength of cohesive soils, together with some opinions and interpretations, will be available in a published Conference Proceedings. Copies of this Proceedings may be ordered from ASCE Headquarters. This mass of information has been collected, analyzed and discussed, all in the span of a very few years.

In discussion of the schools of theory that have developed, it appeared that ASCE, through its Soil Mechanics and Foundations Division, can continue to perform a much needed function if it will consistently and persistently insist upon the use of whatever terminology may be agreed upon. While it is probable that the real scholars in this field are conversant with all forms of terminology, there are many others who will find great facility in consistent adherence to accepted terms and symbols.

From Theory to Practice in One Conference

The program for the Boulder Conference was carefully arranged by a committee, headed by Willard J. Turnbull and including M. Juul Hvorslev, Jack W. Hilf, Reginald A. Barron, Arthur Casagrande, Ralph B. Peck, and H. Bolton Seed. The program proceeded from the theoretical development of analysis and the hypothetical understanding of physical relationships to a careful description of practical applications of such analyses and observed experience. The opening session heard a lecture on failure hypotheses by Nathan M. Newmark. The second session was devoted to problems of the laboratory. In summarizing this, the session moderator, Arthur Casagrande, concluded that the interpretation of test results is still a most important factor and that the human factors involved in such interpretation cannot be neglected. Dr. Casagrande made several proposals for changes in nomenclature, which he feels would facilitate such interpretation of laboratory findings. Careful study is to be given to these proposals.

The next session was devoted to theoretical interpretation of laboratory results. This panel examined "prestress" effects, relationships of time, rate of loading, temperature, and such details on laboratory results. Special attention was given to studies of slickenside clays.

The fourth session, devoted to shear strength of undisturbed cohesive soils, established typical problems, and then indicated several approaches to solutions. The extrapolation from laboratory result to field operation proceeds, even though it still depends upon the judgment of the interpreter. Obviously one of the problems involved is economic. How much testing can be sold, or justified? While everyone seems to have an idea of "progressive failure," as something to be avoided like the plague, there seems to be a variety of interpretations of this term.

Different Approaches Explained

In his conduct of Session No. 5, Moderator H. Bolton Seed gave participants an opportunity to explain the reasons for standard procedures of analysis or design which have been adopted by certain large engineering organizations. The adoption of such a procedure is intended to make the best use of the equipment, accumulated data, and specialized experience of the personnel involved.

Again, the value of experience was stressed, as Philip C. Rutledge summarized the discussions of Panel No. 6, which dealt entirely with practical applications of shear strength data. Moderator Rutledge pointed out that, as more information is collected, practitioners can proceed with assurance when they are working in certain specific geological formations. The papers made available by this session contained very good descriptions of current practices in certain specific geological formations.

Will Word "Cohesion" Be Lost?

In the final session of the conference, numerous interesting viewpoints were presented. Questioning whether the term "cohesion" would become "old hat," Fred C. Walker pointed out there is increasing knowledge of such internal stresses and forces of a physical nature, including molecular forces, capillarity of fluids, and internal friction.

The conference enjoyed the attendance and participation of engineers from several other parts of the world. Several took part in discussions. Three of these had planned parts in the program. They were Laurits Bjerrum, director, Norwegian Geotechnical Institute, Oslo, Norway; Raul J. Marsal, F.ASCE, research engineer, Instituto de Ingenieria, Universitad Nacional de Mexico; Alan W. Bishop, reader in soil mechanics, Imperial College of Science and Technology, University of London.

Encouraged by the very real accomplishments of the conference, the Planning Committee has begun to look forward to another conference, possibly in three years.

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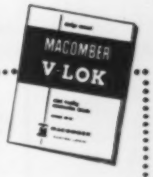

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Need for Professional Schools Seen at Civil Engineering Education Conference

The future of engineering education lies in the development of professional schools superimposed on the undergraduate, pre-engineering curriculum. This is the view of Jack E. McKee, professor of sanitary engineering at the California Institute of Technology and a member of the ASCE Committee on Engineering Education, as expressed at the University of Michigan, July 6-8.

The conference was held under the auspices of the National Science Foundation and was sponsored by the American Society of Civil Engineers, The Cooper Union of New York and the American Society for Engineering Education. Some 250 educators, practicing engineers and industrialists from all parts of the country attended.

Advanced education, administered by engineers on a par with the graduate schools of other professions may be a proper solution. Such engineering schools might award master of engineering and doctor of engineering degrees for the engineer who intends to practice in the profession. The M.S. and Ph.D. could continue to be granted in the regular graduate school for men who plan to teach or to do research in engineering. "Graduates of these programs," Professor McKee told the assembly of the nation's outstanding educators in engineering, "will constitute the truly professional engineering fraternities of the future, with support from subprofessional personnel holding baccalaureates, or with training as technicians."

In a keynote address Nathan M. Newmark, head of the department of civil engineering at the University of Illinois, said that "The major problems faced in civil engineering education are associated with the rapid changes in technology, which progress at a continually accelerating pace. It is no longer possible to provide a background in the practical applications of new developments, even if it were desirable to do so. It has become increasingly obvious to educators that we can only provide a fundamental background of knowledge on which the engineer can build after his formal college education is completed. . . .

"In my opinion," he continued, "major change in civil engineering education is long overdue. This change must be of such a nature as to increase the technical and professional competence of civil engineers and to prepare them for truly professional careers. It must also have within it the means of attracting bright and able young men to our profession in order that civil engineering shall continue to be a vital and productive force in our civilization."

Official delegates—one from each of 138 colleges, universities, and institutions with engineering curricula accredited by the Engineers' Council for Professional Development—had been invited to attend the conference and vote on proposals for the advancement of engineering education. Eleven formal papers and several prepared discussions were presented. A resolution promulgated by the Conference Planning Committee at two earlier sessions was the conference theme. It reads as follows:

Felix A. Wallace (left) assistant dean at The Cooper Union and general chairman of the Civil Engineering Education Conference, is pictured with Prof. Kenneth B. Woods, of Purdue University, and Jack E. McKee, of California Institute of Technology.

"Resolved that this Conference favors the growth in universities and colleges of a pre-engineering, undergraduate, degree-eligible program for all engineers, emphasizing humanistic-social studies, mathematics, basic and engineering sciences with at least three-quarters of the program interchangeable among the various engineering curricula, to be followed by a professional or graduate civil engineering curriculum based on the pre-engineering program and leading to the first engineering degree, with a civil engineering degree awarded only at the completion of the professional or graduate curriculum."

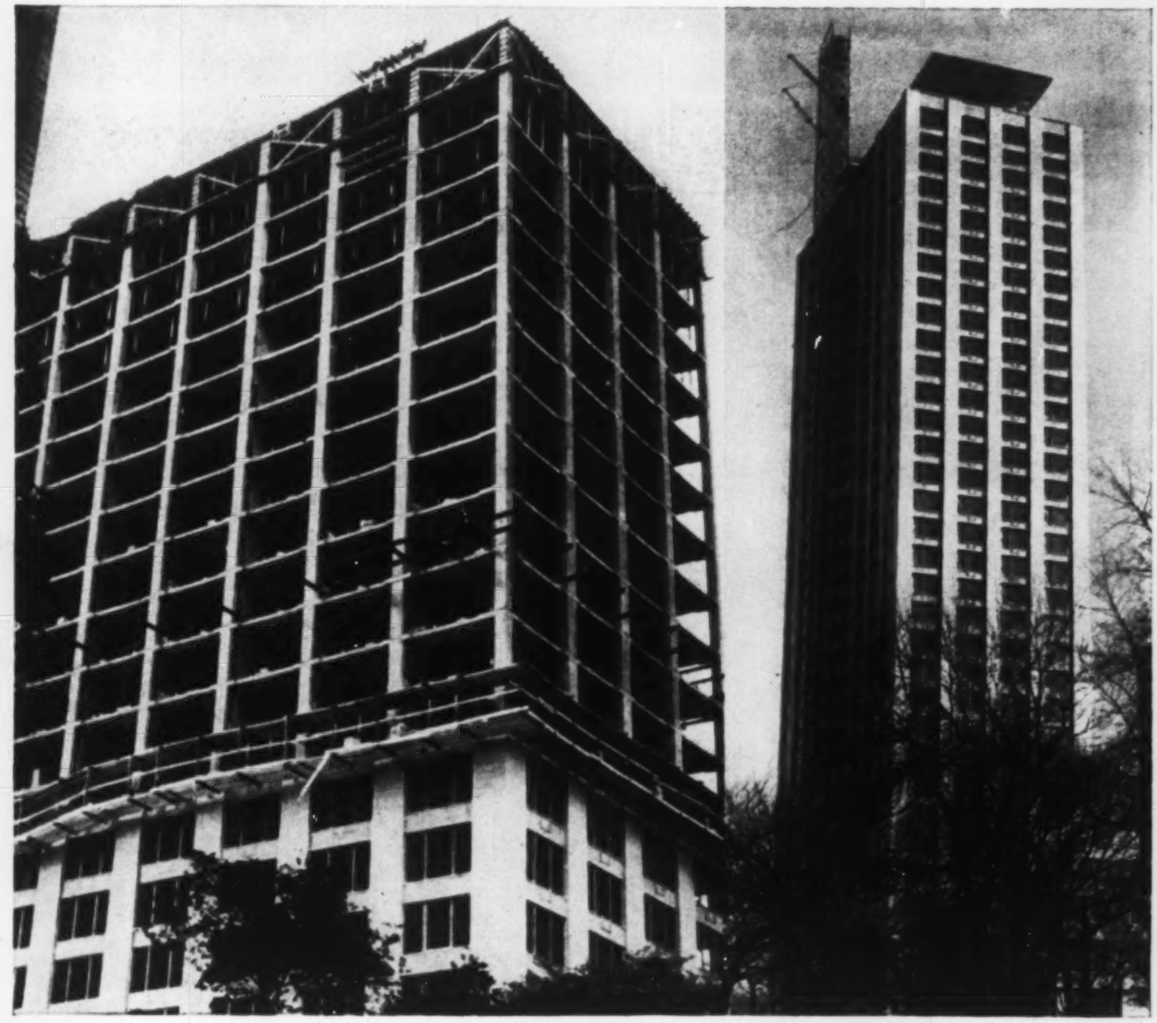
In the development of this theme, much of the Conference program was devoted to:

1. Background and objectives of the Conference on Civil Engineering Education.
2. Proposed structure of the undergraduate curriculum.
3. Professional development.
4. Aims and objectives.

It was a notable conference. It brought together, probably for the first time in history, the world's greatest talent in civil engineering education. The eleven formal papers, representing the nation's best thinking in civil engineering education philosophy, pulled no punches. They tended to support the general thesis of the conference, which was that changes in engineering education are in order. The formal papers and discussions were received with considerable enthusiasm and very little comment. The sessions were unusually well attended. A measure of the enthusiastic reception of the well-prepared papers and the entire program was indicated by the fact that the Friday noon luncheon was not adjourned until late afternoon.

When the meeting was open for discussion it became evident that very little formal action would be taken at the conference on the proposals before it. Alfred Golze, chairman of the ASCE Committee on Engineering Education, asked, as a guide for the ASCE Committee's consideration, if the delegates favored the general theme of the conference. A show of hands almost unanimously confirmed acceptance. Informal concurrence in this theme was one step taken in leading the nation's schools toward improved engineering education. It was voted to publish nine resolutions presented at the Conference, including the "Theme" resolution (above) with provision for a ballot by mail to be taken in the fall.

Cooper Union is to publish 150 copies of the papers and discussions through the facilities of ASCE with a small budget from the National Science Foundation. One of the papers, "The Case for Professional Schools of Engineering," prepared by Prof. Ralph Fadum, appears on page 80. Because of the high quality of the papers and the great interest in the subject matter, the Committee on Engineering Education, ASCE, is recommending to the Board of Direction that ASCE provide an additional 1,000 copies of these proceedings to be made available at minimum cost. If, and when, this is available it will be announced in Civil Engineering.



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ASCE Honorary Member Jonathan Jones Dies

Jonathan Jones, an Honorary Member of ASCE and one of the foremost structural engineers in the country, died in Bethlehem, Pa., on June 25. He was 78 years old. During a career spanning fifty years, Mr. Jones had direct engineering supervision of the construction of many major bridges in this country, such as the George Washington Bridge, the Golden Gate Bridge, and the Chesapeake Bay Bridge. He also had complete engineering responsibility for both design and construction of the Ambassador Bridge from Detroit to Windsor, Ontario.

Mr. Jones, who retired eight years ago as chief engineer of the Bethlehem Steel Company's Fabricated Steel Division, had spent his career with Bethlehem Steel and its predecessor organization, the McClintic-Marshall Company, with the exception of two years with the Pennsylvania Railroad at the outset of his career and seven years (1913 to 1920) with the City of Philadelphia as engineer of bridges.

Mr. Jones, in 1906, received an M.S. degree in civil engineering from the University of Pennsylvania where he was elected to Phi Beta Kappa and Tau Beta Pi, honorary scholastic fraternities.

A member of ASCE since 1910, he had served as president of the Lehigh Valley Section and as chairman of the ASCE Executive Committee of the Structural Division. He was elected Honorary Member in 1951.

Honorary Member Robert Cummins Is Dead

Robert J. Cummins, Honorary Member of ASCE and a leading Houston, Tex., consulting engineer, died in that city on June 11 at the age of 79. For half a century he was identified with the design of industrial, educational, and civic buildings that dot the Houston skyline. Mr. Cummins arrived in the United States in 1901 from his native Ireland after receiving engineering and art degrees from Queens College, Galway.

Examples of his engineering contributions to his adopted state include numerous University of Houston buildings, the U.S. Veterans' Hospital and the famous San Jacinto Monument. In addition to responsibility for marine installations along the Houston Ship Channel, Mr. Cummins played an important part in the development of the Houston Port as a member of the Houston Port Commission for 25 years and vice chairman for 15.

On the national level he acted as special engineer adviser to the Reconstruction Finance Corporation on the Metropolitan Water District of Southern California and on the San Francisco-Oakland Bay Bridge, and as technical adviser to the International Boundary Commission for the United States and Mexico.

Since joining the Society in 1920 Mr. Cummins had been president and director of the Texas Section and chairman of ASCE's Committee on Juniors and the Committee on Employment. He was elected Honorary Member in 1954.

* * *

Tellers Canvass Ballot for 1961 Officers

To the Secretary
American Society of
Civil Engineers:
New York, N. Y.
June 30, 1960

The Tellers appointed to count the Ballot for Official Nominees report as follows:

For Vice-President—Zone II
(Term October 1960-October 1962)

Donald H. Mattern	836
Candidate withdrew	85
Scattering	378
*Ineligible Candidate	34
Void	7
Blank	54
Total	1,394

For Vice-President—Zone III
(Term October 1960-October 1962)

Don M. Corbett	955
William J. Hedley	911
Scattering	265
*Ineligible Candidate	4
Void	0
Blank	20
Total	2,155

For Director—District 1
(Term October 1960—October 1963)

Roger H. Gilman	230
Arthur T. Larned	52
Scattering	158
*Ineligible Candidate	102
Void	2
Blank	17
Total	561

For Director—District 2
(Term October 1960-October 1963)

Henry W. Buck	218
Scattering	57
*Ineligible Candidate	77
Void	0
Blank	3
Total	355

For Director—District 6
(Term October 1960-October 1963)

Earle T. Andrews	287
Scattering	42
*Ineligible Candidate	19
Void	1
Blank	10
Total	359

For Director—District 9
(Term October 1960-October 1963)

John B. Scalzi	382
Scattering	57
*Ineligible Candidate	35
Void	0
Blank	14
Total	488

For Director—District 10
(Term October 1960-October 1963)

John D. Watson	583
Scattering	74
*Ineligible Candidate	36
Void	1
Blank	7
Total	701

For Director—District 11
(Term October 1960-October 1963)

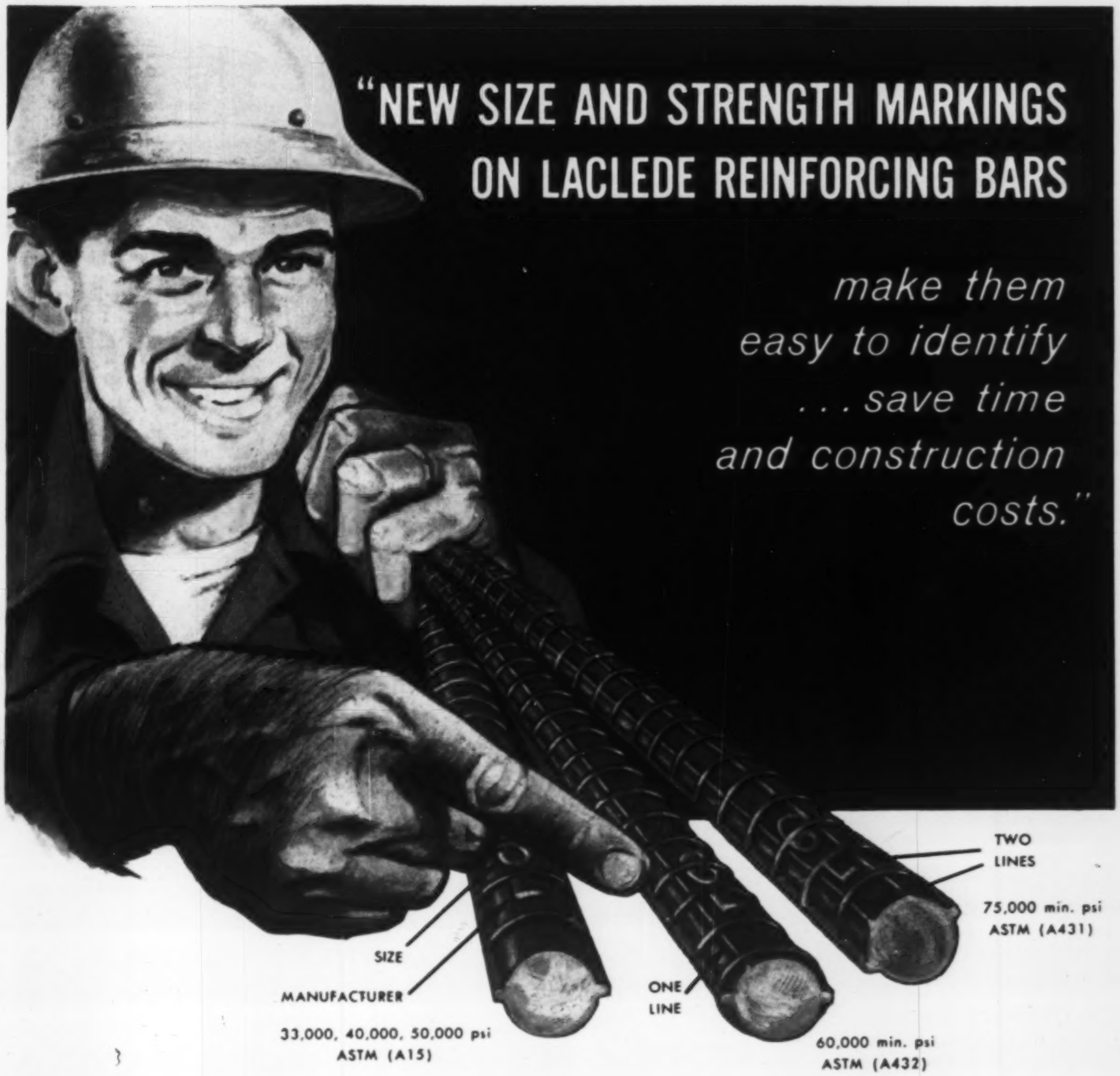
Harmer E. Davis	681
Scattering	196
*Ineligible Candidate	173
Void	0
Blank	11
Total	1,061
Total number of ballots counted	7,074
Ballot envelopes without signature	13
Dues arrears	8

Respectfully submitted,
JOSEPH N. RIZZI, JR.
Chairman

RICHARD D. EGAZARIAN
Vice-Chairman

Neal H. Bettigole
Anthony J. Castro
George A. Dennis
Leon Goodman
David B. Hill
Edward O. Streich
Tellers

*These votes were cast for incumbent officers who are presently ineligible for re-election in accordance with Section 9, Article VI, of the Constitution.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ASTM (A432)

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The Younger Viewpoint

Committee on Younger Member Publications

Walter D. Linzing, Chairman; 4751 No. Paulina, Chicago 40, Ill.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 289 Foxhill Road Denville, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	William R. Walker 4600 Franklin Ave. Western Springs, Ill.	Judd Hull 3178 Almeria San Pedro, Calif.

This month's editor is William R. Walker, Zone III representative, who has edited and forwarded the following material from the Middle West:

Advice to Job Seekers

This month's editor read with interest the letter by Duane R. Miedtke, president of the University of Minnesota Student Chapter, that appeared in "The Younger Viewpoint" several months ago Mr. Miedtke addressed himself to the problem, "How do we find an opening in this [the construction] field?" Students approaching graduation should realize that our capitalistic system is based on the general proposition that each of us must perform a service or satisfy a need if we are to survive economically. If, as the time for graduation approaches, the procurers of engineers are in a buyers market, then the young engineer must create a demand or do what is commonly known as "sell"—sell the only product he has, himself. With a little imagination, research, and hard work, he can sell himself much as a company does a product.

Determine Goals

First, the student must determine what his ultimate goals are, then formulate a plan to get there. The next step is to evaluate his background and experience to determine what his accomplishments are, which of his experiences would best demonstrate to an employer that he has a desirable and marketable product. While most graduates lack engineering experience except for summer-time employment or work done under a cooperative program, they can cite college and community activities which would show a prospective employer that the prospective employee has potential. Leadership in directing others is readily demonstrated by college activities.

Letters to Employers

After the student has formulated his accomplishments, he should make a list of 50 to 100 firms for whom he might like to work. (The yellow pages of the telephone book, contacts with the construction departments of public agencies, and nearby Associated General Contractors' offices could prove helpful here.) All letters should be directed to a partner or officer of the organization. Letters should be individually typed on good bond paper. The letter should state what the applicant has to offer in terms of his previous accomplishments. No claims should be made unless they are substantiated in the letter.

Preparing such an approach will take considerable time, but it will pay handsome dividends in responses. It will also help to give direction to the student's thinking and give him an opportunity to make a connection that would not have been possible had he waited for employers to come to his campus.

Thoughts on Professionalism

The following are some comments received in a letter from Otto J. Stepanek regarding engineers and the engineering profession:

"It appears to be common practice today for engineers employed by an organization, such as a consultant or educational institution; to solicit and contract projects for their own benefit. These men have a tendency to do the job for almost nothing, so that the results are bad for everyone. A possible solution might be an accurate recording system showing who gets the job and for how much.

"There are phases of civil engineering such as the structural engineering field which are very complicated. After the young engineer has been out of college for some time, he finds it very difficult to keep up with all the new developments . . . It would be extremely helpful for practicing engineers to have some way of keeping up with the new techniques. A possible solution might be the organization of 'Technical Groups' where engineers could exchange ideas and develop new techniques."

[*Some Sections, notably Los Angeles, have such Technical groups. Papers can be prepared for Journals for quick distribution to interested people.*]

"The engineers' participation in activities of other societies is a puzzling question. For example, the ASCE seems to favor the Engineers Joint Council rather than NSPE. Does this mean the practicing engineer should not join the NSPE?"

Executive Secretary Wisely was asked to reply to the question about joining NSPE. Here is his answer: The practicing engineer should indeed join NSPE —as I have done myself—if he is interested in his profession and wishes to participate in advancing it. NSPE is especially well equipped to promote engineering registration and to support the interests of engineers who are registered.

In the same manner that ASCE welcomes collaboration with NSPE at the national level, it encourages its 78 Local Sections to join in state and local activities with local units of other societies. This has been done effectively in state and local councils. The principle of "cooperative effort in the common interest" is applicable at any level. To advance this principle on an individual basis engineers can properly belong to NSPE or other professional societies in addition to ASCE.

The Board of Direction of ASCE has gone on record to favor a merger of ECPD and EJC into a single entity. This coalition preferably would retain the identity of ECPD in so far as the accrediting medium for engineering education is concerned, and would absorb other professional functions of ECPD into the broader base that is provided in EJC. ASCE has urged NSPE to affiliate simultaneously with both EJC and ECPD on an equivalent status with that of each of the five Founder Societies.

For a complete definition of the ASCE philosophy of engineering unity see editorials in August 1957 and September 1959 issues of Civil Engineering.

Associate Member Participation

The Younger Viewpoint for June had some suggestions for soliciting the participation of Associate Members. Mr. Walker offers his comments regarding these suggestions:

Associate Member Forums Effective?

The creation of an Associate Member Forum appears to have only limited success if we are to learn anything from the history of its predecessor, the Junior Member Forum. It is my recollection that even in the successful Sections, there is not enough history to forecast whether its achievements are due to a program which serves a continuing need or whether they are due to existing members and likely to falter as they move up in grade.

I have a sincere doubt whether a letter or a group of mailings could motivate action on the part of a rather indifferent audience. Perhaps mailings, if part of a sustained program to promote Associate Membership, would have merit.

Committee Appointments

Appointment of an Associate Member to all local committees seems to me to have the most merit. This would only be true if the committees were quite active. Active participation on committees offers the stimulus to turn an indifferent member into a vitally interested member. An Associate Member should not

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overlook the personal advantage which can result from such activity. It would place him in intimate contact with outstanding engineers on a very informal basis. Success and development in engineering, like any other profession, depend at least in part on friendships. A committee assignment presents the avenue along which long and lasting friendships have their origin and development.

More Student Chapter Contact

Coordination between Local Sections and Student Chapters could be greatly improved. Closer contacts would foster an attitude in which ASCE participation would be considered an almost indispensable part of professional development. I feel that both groups would benefit from this more intimate contact. It would certainly help to break down the attitude which has considerable support, that ASCE is operated and maintained to "honor old men." The worth of any organization can best be measured by its contribution to its members, *but more important by what it has contributed to society as a whole.*

Personal Membership Solicitation

The value of personal solicitation can never be overvalued. It must, however, be done by persons talking to their friends and not to strangers. Every active ASCE member should be a committee of one to encourage others to join, and then through their local officers obtain assignments which will help maintain the level of interest which prompted their joining.

I would be interested in hearing from Sections who have used these or other means to secure more active participation by Associate Members. One should critically analyze the methods used in his Section to see if they are fundamentally sound and have universal application. Many times a method is successful only because of local conditions or the persons involved.

EJC Delegation Studies Manpower in Soviet Union

An Engineers Joint Council delegation representing the engineering profession in the United States is in the Soviet Union this summer studying the utilization and allocation of Russian engineers and technicians. The trip, which is under the auspices of the National Science Foundation and the U. S. State Department, is a part of the Soviet-American program of scientific, technical, and cultural exchange. It was made at the invitation of the Soviet Ministry of Higher Education. A Soviet team will visit the United States at a later date.

Delegates were chosen by Engineers Joint Council on the basis of professional training and experience and their knowledge of engineering manpower. Walter E. Lobo, consulting chemical engineer of New York, is chairman of the delegation, which represents a cross section of engineering specialties, engineering education, and economics.

Professional Practice of Surveying and Mapping

To further promote Surveying and Mapping as professional work, a letter is being sent from Society Headquarters, under Executive Secretary Wisely's signature, to agencies that might be contracting for such services. The text was prepared with the assistance of the Task Committee on Professional Practice of Surveying and Mapping. A typical letter follows:

The ASCE Board of Direction acted in 1959 to clarify the status of surveying and mapping services in the broad area of professional civil engineering activity. Following is the policy statement that was adopted:

"The American Society of Civil Engineers, on the basis of thorough studies carried out by a Task Committee on the Status of Surveying and Mapping, declares that the following four major categories in the field of activity commonly designated as surveying and mapping are a part of the Civil Engineering profession:

"I. Land Surveying
II. Engineering Survey
III. Geodetic Surveying
IV. Cartographic Surveying"

[These categories are described in the May 1959 issue of Civil Engineering (pages 74 and 75) from the Final Report of the Task Committee on Status of Surveying and Mapping. A copy of this is attached to each letter. It is available to members of ASCE as Proceedings Paper No. 2166.]

"Further, the Society declares that professional and technician positions within these categories should be classified according to the chart. . . .

"We respectfully solicit your thoughtful consideration of the principles embodied in the statement of the Board and in the report on which it is based. It is especially desirable that you review your procedures for engaging these services with a view toward possible modification as a result of the new policy."

ASCE CONVENTIONS

ANNUAL CONVENTION

Boston, Mass.
Hotel Statler
October 10-14, 1960

PHOENIX CONVENTION

Phoenix, Ariz.
Hotel Westward Ho
April 10-14, 1961

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 16-20, 1961

DISTRICT CONFERENCES

DISTRICT 6 COUNCIL

White Sulphur Springs, W. Va.
Greenbrier Hotel
September 22-24, 1960

TECHNICAL DIVISION MEETINGS

CONFERENCE ON ELECTRONIC COMPUTATION

Pittsburgh, Pa.
Hilton Hotel
September 8-9, 1960

Sponsored by

Structural Division

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.28	1.13
Baltimore	1.14	1.14
Boston	1.22	1.22
Chicago	1.45	1.43
Denver	1.24	1.21
Houston	1.26	1.26
Kansas City	1.13	1.16
Los Angeles	1.28	1.23
Miami	1.57	1.57
New Orleans	1.18	1.18
New York	1.25	1.28
Pittsburgh	1.07	1.04
Portland (Ore.)	1.27	1.25
San Francisco	1.30	1.24
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	1.01	0.90
II, Mid Atlantic	1.14	1.14
III, Mid West	1.27	1.22
IV, South	1.12	1.14
V, West	1.06	1.03
VI, Far West	1.17	1.13

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current total of base entrance salaries for ASCE Grades I, II, and III by an arbitrary base. The base used is $15,930, the total of salaries paid in 1956 for Federal Grades GS5, GS7 and GS9. Index figures are adjusted semiannually and published monthly in Civil Engineering. Latest survey was January 30, 1960.

Some Ideas

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A New Type Of Typing Paper

Translucent typewriter papers are very popular of late for typed originals from which numerous copies must be made. The savings are considerable when you use translucent originals through diazo reproduction—savings up to 80% in many cases. But most translucent papers used today stand erasure very poorly. Recognizing the inevitability of human error, K&E has perfected a better translucent typewriter paper called TYPEMASTER® (193)—the perfect answer for those whose typing is less than perfect. TYPEMASTER's completely new, *engineered* surface affords outstanding erasability. A thin, unusually tough coating, it readily catches and holds the typewritten image, yet resists penetration of the ink into the paper fibers . . . and therein lies the secret of good erasability. A number of skeptics who tested the new TYPEMASTER sheets have now discarded all others. Skeptical or not – may we suggest you try it.

Tracing Pads "To Travel"

Brilliant ideas often occur at random moments. For that reason, engineers on the move usually keep a tracing pad handy. But pads with soft, chipboard backing are of little use without a desk under them. That's why all K&E tracing pads are backed with sturdy bookbinder's board – the same tough board found in any high-priced, permanently-bound library volume. Wherever you are you're assured desk-firm support with a K&E pad. Another plus – the sheets are bound in by a gummed edge for neat and easy removal. Available in a wide variety of grid patterns and sizes, with plain or imprinted sheets (standard headings), K&E book-bound, gummed-edge tracing pads are perfect workmates for the "portable" professional.

The Most Pampered Natural Paper In America

For the greatest transparency, the overwhelming choice is K&E ALBANENE® prepared tracing paper. But for ability to stand a lot of abuse on the drawing board and in subsequent processing and handling —many companies prefer to sacrifice some transparency and use a *natural* tracing paper. Here we recommend a truly remarkable K&E product—BANKNOTE$^{\text{T.M.}}$ (174L). This thin, flexible, 100% rag tracing paper will weather a double share of abuse. You can actually crumple a sheet of K&E BANKNOTE up into a tight ball . . . then smooth it out to find it almost as good as new for reproduction purposes! The paper makers who produce BANKNOTE for K&E proudly refer to it as America's most pampered tracing paper. No other paper we know receives the same care and attention . . . from initial inspection of the textile bales, through every step of processing, to final shipment. With K&E BANKNOTE, papermaking skills come into play as with no other paper made on this side of the Atlantic – from use of a paper machine that runs a "top jacket" (one of the few still employed), through the artful "wet packing" process, to careful air-drying, super calendering, and rewinding. The result is a sheet of unsurpassed mellowness, yet with unusual stamina and workability.

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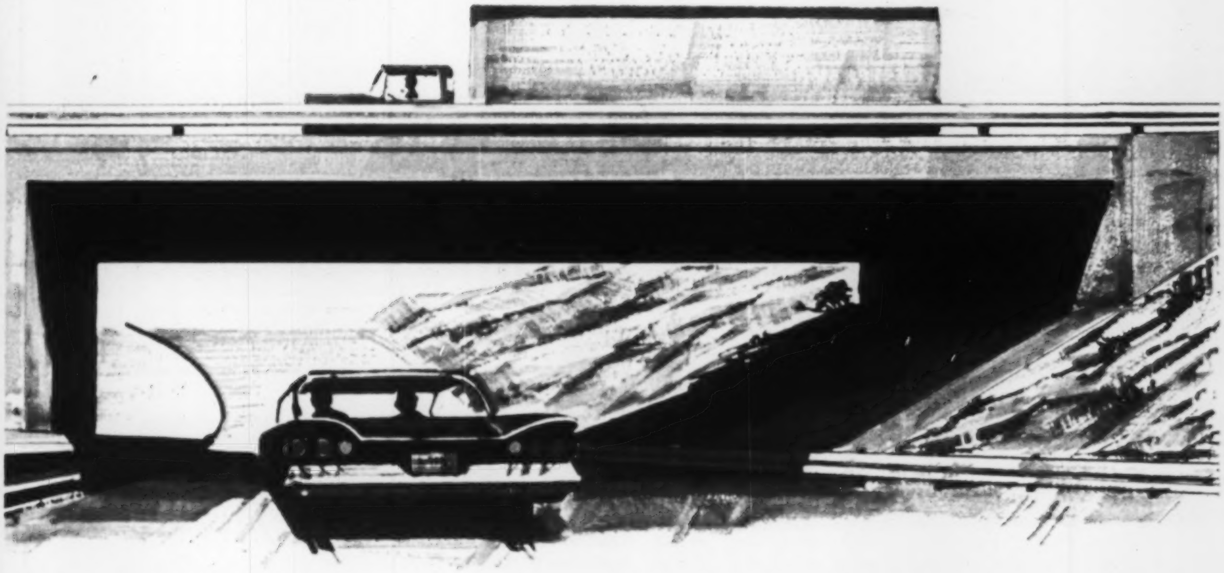
Gage:	10 and 12
Length:	12′-6″ and 25′-0″ (25′ sections supplied in 12-gage, galvanized steel only).
Coating:	Shop applied, rust-inhibiting prime paint or Galvanized to meet ASTM A-93 (Class 2.5 oz. coating).
Shop-Curved Sections:	Fit any radius from 5′ to 150′.



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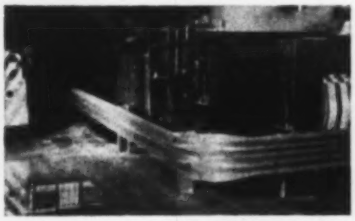

FLEX-BEAM protects valuable machinery in plant.

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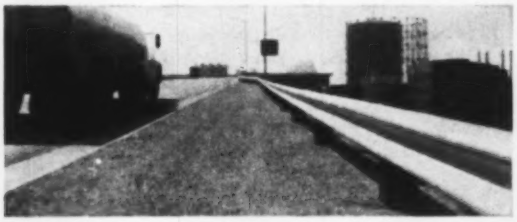

FLEX-BEAM installation on Chicago's Calumet Skyway.

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BY-LINE WASHINGTON . . . . .

Politics will be the principal activity in Washington, as Congress comes back to work this month. That is no startling conclusion but it should be remembered that what the lawmakers do will take place in what promises to be a short, hot, final session.

* * *

With that said, you can make a fair assessment of what will happen to the mountain of legislation that still awaits action. As noted earlier, most of it will be swept aside. Only politically promising (or embarrassing) measures will get much attention except for the handful of appropriations bills that still awaited passage when the July political vacation started.

* * *

From the standpoint of engineers and the construction industry in general, here are the important bills that will certainly be handled: Appropriations (roughly $1 billion for public works, including Army civil works and the Bureau of Reclamation); appropriations (about $4.5 billion) for the Departments of Labor and Health, Education and Welfare, representing a jump of nearly a half-billion over the President's budget requests; federal aid to education bills (somewhere between $1.3 and $1.8 billion); federal aid for housing construction ($235 million in direct grants, $1 billion added mortgage-purchasing authority for the Federal National Mortgage Association); various labor bills affecting the minimum wage and "common situs" picketing; tax-exemptions for the self-empolyed; legislation affecting employment of retired military officers; other amendments to tax laws concerning depreciation, taxation by other states, allowable "entertainment" items.

* * *

On the side of what was done before Congress left early in July, there is this list: Appropriations for "ABC" (primary, urban and rural) highways, $925 million (after a conference committee battle over the Senate's attempt to add $100 million as an "emergency fund"); appropriations for military construction work, at $1.07 billion; authorization for public works at $1.4 billion (that's a kind of a hunting license with which to seek future appropriations); appropriations for Defense (about $40 billion, other than construction), State, Agriculture and independent offices; and a bill approving a two-year study of air pollution by motor vehicles.

* * *

It seems unlikely that a long list of other legislation of particular interest to professionals will be acted upon. This includes moves to raise the pay of consultants from $50 to $100 a day, establishment of a new registration category of "federal engineer," various bills setting up "wilderness" areas in the West, creation of a "Department of Housing and Metropolitan Affairs," further restrictions on activities of newly retired military officers in dealing with the Defense Department, and bringing the Interstate Commerce Commission into a commanding position with respect to feasibility determinations on rivers and harbors projects.

A bad case of quoting-out-of-context afflicted the item in this column (Civil Engineering, June, p. 108) concerning the amount of work done by the Corps of Engineers with outside consultants. As indicated in a letter in this issue (see p. 93), the figures given by Lt. Gen. E. C. Itschner referred to the percentage of construction contracts awarded by competitive bidding, not to percentage of engineering work done by the Corps "in house." The fact is that, in the past five fiscal years, the Corps has used consulting firms to design an average of $1.3 billion of construction each year, an aggregate of $6.5 billion for the period.

* * *

Contemplated improvements to the existing Panama Canal should handle normal traffic increases for the next 40 years. Thus no new canal is justified now, according to a five-member Board of Consultants which has completed a three-year study for the House Committee on Merchant Marine and Fisheries. Eventual answer to canal problems, said the board, must be a sea-level route. Studies of six possible routes in Colombia should be carried on. Board members include Francis S. Friel, Gen. Leslie R. Groves, S. C. Hollister, Hartley Rowe and John E. Slater.

* * *

Going along with a new trend in airport facilities, the Federal Aviation Agency has asked bids (by September 2) for construction of a hotel of about 200 rooms for its now-building Dulles International Airport at Chantilly, Va., about 28 miles west of Washington. The hotel would be located on a 10-acre site set aside for it near the terminal building. Sleeping-car-like facilities have already been put into operation at Washington National Airport.

* * *

Washington got a new Corps of Engineers officer in the key post of Engineer Commissioner August 1, when Col. Frederick J. Clarke took over the post vacated by a new assignment for Brig. Gen. Alvin C. Welling. Colonel Clarke, a West Point graduate with a master's degree in civil engineering from Cornell University, has considerable background in atomic energy work, as well as in more normal construction activities of the Corps. As Engineer Commissioner, he will be the city's "Public Works Commissioner" and a member of its three-man governing council. General Welling, one of the few to complete a full three-year term, moves on to a new assignment, not disclosed as the shift in posts was announced.

* * *

A new organization—the National Center of Atmospheric Research—is being set up at Boulder, Colo., under the direction of Walter Orr Roberts who has been director of the High Altitude Observatory, also at Boulder since 1940. Its first job, under a $500,000 National Science Foundation grant, will be to determine the feasibility of applying the techniques of the basic sciences and engineering to problems of the atmosphere.

Concrete Adhesives With THIOKOL Liquid Polymer

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1. Scaled highway surfaces are being lastingly repaired in only a few hours by bonding new concrete to old with adhesives containing THIOKOL polysulfide polymer. The bond is stronger than concrete itself. Field and lab tests prove it.

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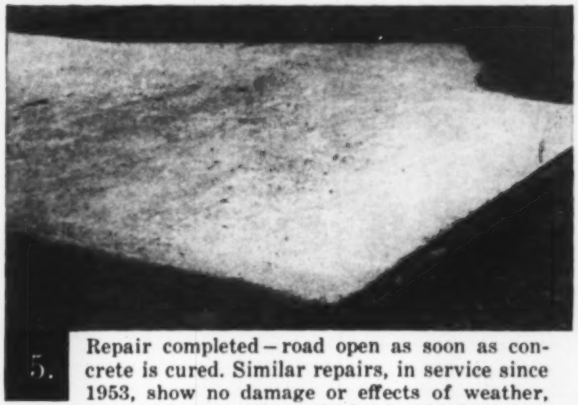
3. Adhesive with THIOKOL liquid polymer—made and sold commercially by several processors—is spread on prepared surface with brooms or heavy brushes. Thirty minutes later, while adhesive is still tacky, new concrete is poured.

4. Concrete is laid conventionally. It can also be worked out to a feather-edge without danger of later failure—so tenacious is the adhesive bond of new to old concrete.



5. Repair completed—road open as soon as concrete is cured. Similar repairs, in service since 1953, show no damage or effects of weather, wear and tear, even on the busiest highways.

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News Briefs . . .

Broader Use of ASTM Standards Urged at Annual Meeting

Technical assistance to underdeveloped countries, in the form of ASTM standards, would provide a wealth of information on materials not available in any other form, and would be a sure way to put international trade in materials on a sound base. These points were made by F. L. LaQue, retiring president of the American Society for Testing Materials, at the President's Luncheon during the 63rd annual meeting of the organization held in Atlantic City in June.

In outlining the already international scope of ASTM, Mr. LaQue noted that it now has members in more than 50 countries; that in 1959 it received more than 9,000 orders for publications from more than 65 countries, from Afghanistan to the Windward Islands; and that for some time it has been making substantial contributions to the work of the International Standards Organization, through the American Standards Association.

"Our government is committed to a policy of providing technical assistance to other countries, and particularly to what are called 'underdeveloped' countries," said Mr. LaQue. "In the field of materials, the 14,359 pages in the ten volumes of ASTM standards comprise the greatest concentration of immediately available and practically usable information that could be furnished anyone needing such data . . . In most cases, no further work or search for data should be required to characterize a material needed for some specific purpose, whether it be concrete for a wall, steel for a bridge, or fuel for an engine."

Mr. LaQue pointed out that an ASTM standard is the best available way for a foreign purchaser of U. S. materials to describe what he wants and to be sure of getting what he asks for. This is of obvious benefit to domestic producers in increasing the volume of their export business, he said. For the U. S. manufacturer, competing in the world market on the basis of superior qualities that can be described, assured, and measured by reliable means, nothing will be more helpful than the general use of ASTM standards. To help promote the wider use of these standards abroad, said Mr. LaQue, there is need to translate them into other languages. Steps are already under way to do this for Latin America, and the outgoing president urged that his successors pursue the matter on a broad international scale.

New ASTM Officers

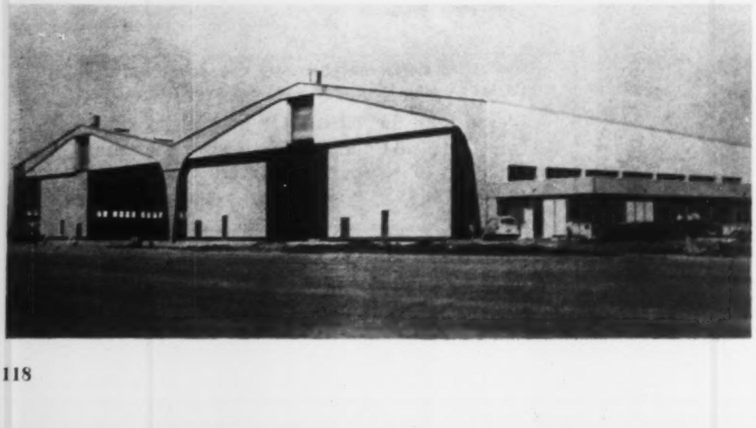
The election of new Society officers was announced during the meeting. A. Allan Bates, F. ASCE, vice-president of research and development, Portland Cement Association, Chicago, is president for a one-year term. Russell Wade Seniff, manager of research for the Baltimore and Ohio Railroad, Baltimore, Md., was elected vice-president. Miles N. Clair, F. ASCE, president of the Thompson & Lichtner Co., Brookline, Mass., will continue as senior vice-president of the society. New members of the Board of Directors, elected for three-year terms, include Robert F. Legget, F. ASCE, director of the Division of Building Research, National Research Council, Ottawa, Canada.

Three ASCE Fellows were among nineteen leaders in the field of engineering materials who received Awards of Merit for "outstanding service" to the ASTM. They are Harold F. Clemmer, engineer of materials and standards, District of Columbia Highway Department, Washington; Harry C. Plummer, director of engineering and technology, Structural Clay Products Institute, Washington; and Charles H. Scholer, head of the Department of Applied Mechanics, Kansas State College, Manhattan, Kans. All were cited for long and distinguished service on ASTM technical committee work.

Approximately 3,000 members and guests attended the 37 technical sessions during the week-long meeting. About 60 of ASTM's 80 technical committees held upwards of 900 committee meetings during the week. Topics ranged from basic research in materials sciences to the most practical aspects of engineering design and construction.

Super Service Station for Jet Transport

New municipal hangar at Oklahoma City's Will Rogers Field is big enough to service two jet transports at the same time. The overall structure, which is 405 ft wide and 161 ft deep, features a double-span steel framework, chosen as the most economical of several designs under study. Special doors above the main sliding doors in each hangar bay roll up to admit the tail structures of huge jet planes. Siding is of heavy corrugated steel, and the roof deck is an acoustical material providing both strength and insulation. Main beams, supporting beams, and roof joists require 500 tons of structural steel, which is being furnished by the Tennessee Coal & Iron Division of U. S. Steel. The project is part of Oklahoma City's ambitious terminal expansion program.



June Construction Down From Last Year's Level

Though the $4.9 billion spent on new construction this past June was 7 percent above the May level, it was a less than normal rise for the period and down 5 percent from June 1959 expenditures. Similarly, the cumulative value of construction expenditures for the first six months of this year, amounting to $24.5 billion, is 3 percent below the comparable period of 1959.

Spending for new private construction this June was 7 percent above the May level, but 4 percent less than in June 1959. The drop in private construction over last June is attributed largely to a 9 percent decline in residential construction. Total spending for private construction in the first six months of this year was at about the same level as last year. Public construction expenditures in June registered a 9 percent drop from June 1959, and spending in the first six months of this year was down 10 percent from last year.

These estimates are from the U. S. Department of Commerce's Bureau of the Census.

Steel Slump Laid to Inventory Cutbacks

Inventory cutbacks and reduced demand from normally large users of steel are seen as major reasons for the present slump in steel production. For the past two months steel orders have been sufficient to support a steel operating rate of only 42 to 45 percent of the industry's rated capacity. There have been drastic drops in orders from the railroads, from the oil and gas industry, and from many other normally major consumers. Buying appears limited to smaller customers, and a sort of hand-to-mouth method of buying seems to prevail.

According to the American Iron and Steel Institute, warehouses take nearly 20 percent of the entire output of the industry and have become its best single customer. Now, however, warehouse inventories are at an all-time high of 3,800,000 tons, or 100,000 tons more than they were before last year's steel strike. For seven consecutive months warehouse shipments have declined from 5 to 10 percent from the month before. Shipments for the year will probably come to about 7,500,000 tons, compared with 9,300,000 tons last year. To help combat this trend, the warehouses are now cutting their prices, which are currently running from 4 to 5 percent below the 1959 average.

Incidentally, in the belief that the word "warehouse" gives the public a misleading idea of its role in the distribution of steel, the American Steel Warehouse Association has changed its name to the Steel Service Center Institute.

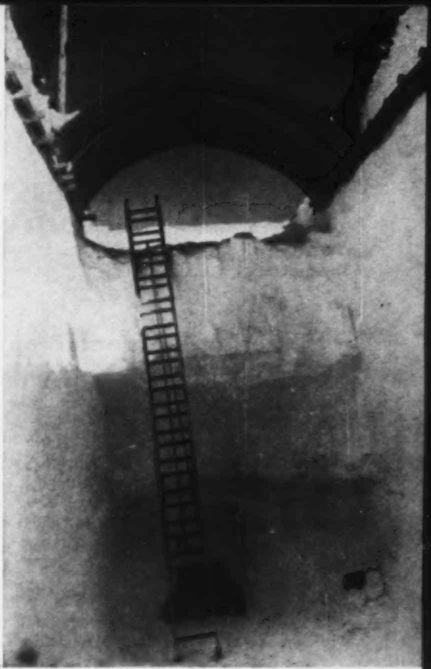
Valuable Engineering Reference Available

All who recall Dean James K. Finch's memorable articles on engineering history published in 1957 and 1958 issues of CIVIL ENGINEERING will want to read *The Story of Engineering,* which has just been published by Doubleday & Company in its Anchor Book series. The invaluable 525-page reference incorporates the CIVIL ENGINEERING articles. Its 22 chapter heads introduce a wide range of material—from engineering developments in ancient Egypt to present-day construction. Though primarily concerned with the development of civil engineering through the ages, the book also gives authoritative outlines of the other major branches of the profession. The 118 illustrations include reproductions of a number of rare plates.

Though of necessity written in "outline-survey form," *The Story of Engineering* reflects the richness of Professor Finch's background as teacher and author. He retired in 1952 as dean of engineering at Columbia University after more than forty years on the faculty. Professor Finch has been active in many phases of ASCE work and has served a three-year term as Director.

The Story of Engineering sells for $1.45 in the United States and $1.65 in Canada. Doubleday & Company may be addressed at Garden City, N.Y.

Street Takes Shape Under Greenland Ice Cap



Streets and avenues for a unique city beneath the Greenland ice cap are taking shape with the aid of corrugated steel sheets that serve as roof forms while the snow is piled on top. When the snow has hardened the steel is removed, leaving a smooth, permanent roof of snow. "Main Street" is 24 ft deep and 20 ft wide, with walls and roof of snow and ice. Buildings will be of insulated, prefabricated shells that can be erected within the chambers hollowed out of the snow. The snow city, known as Camp Century, is being built by the Army on the Greenland ice cap, some 800 miles from the North Pole. Meteorologists, engineers, and scientists will conduct polar research and development programs there the year around.

Master Plan Asked for Quake-Stricken Morocco City

The firm of Harland Bartholomew and Associates, city planning consulting firm of St. Louis, Mo., has been engaged by the International Cooperation Administration to prepare a master plan for the City of Agadir, Morocco, recently devastated by an earthquake. The Government of Morocco has asked the ICA to provide assistance in establishing a city plan for the rehabilitation and reconstruction of Agadir.

Agadir, on the south coast of Morocco, was destroyed in February 1960 with an estimated loss of 12,000 lives and 15,000 homeless. The plan, which will require six months for completion, will determine how and where the new city of Agadir will be built.

Throgs Neck Bridge on Schedule

Two of the largest steel girders ever shipped by railroad and carfloat are shown on the front cover passing under Throgs Neck Bridge in New York. The girders are 191 ft long and 12 ft 8 in. deep. They were shipped via Pennsylvania Railroad from Bethlehem Steel's Pottstown, Pa., works, to Jersey City for storage (see photo) and were reshipped on four railway cars by carfloat to the bridge site.

Bethlehem Steel Co. ironworkers erected the 326-ft steel towers for the Triborough Bridge and Tunnel Authority's new facility and have set most of the approach spans on the Queens approaches to the bridge. The American Bridge Division of U.S. Steel Corp. is erecting the suspended span, seen in the background and Harris Structural Steel is completing the Bronx approach.

Throgs Neck Bridge is about on schedule for opening early in 1961. It will connect the eastern Bronx with the Clearview area of Bayside on Long Island. The new bridge, including approaches, has a total length of 12,000 ft and will carry six lanes of traffic. The suspended portion has a center span of 1,800 ft with side spans of 555 ft. Approach spans vary from 50 ft to the 191-ft girder shown. The big girder is built up from a 9/16-in. web plate with angles up to 8 x 8 x 7/8 in. and cover plates.

Two curved Taintor gates, each 157 ft wide and 30 ft high, form a movable dam that rises to pass excessive discharge or ice floes on the lower Rhine in the Netherlands. The photo is a model of the lift gates.

Netherlands Canal Project to Improve Lower Rhine

An ambitious dual-purpose canal project is under construction in the Netherlands. The project, which is expected to take twelve years to complete and cost about $36,000,000, has a twofold purpose: (1) to improve the navigability of the lower Rhine and its tributary, the Lek, and of the Yssel, linking the lower Rhine with Yssel Lake, and (2) to improve the supply of fresh water for low-lying regions in northern Holland.

A part of the overall Delta Works plan for closing a number of tidal estuaries in southwestern Holland, the Rhine-Lek project must be timed with the closing of the Haringvliet tributary. If the Rhine-Lek canalization is put into effect before the closing of the Haringvliet, the quantity of fresh water flowing past Rotterdam to the North Sea might be reduced to such an extent that salt water would encroach inland.

The overall plan calls for the closing of the Haringvliet by means of sluice gates—probably in 1968. This will compel a great deal of fresh water from the Maas and the Waal to flow out to sea via Rotterdam. As a result, salt water encroachment will recede, thus compensating for reduced discharge in the Rhine and the Lek.

The canalization of the lower Rhine and the Lek, originally conceived in the 1930's, comprises the building of three dams with locks, each capable of raising the water level from 8 to 10 ft in the dry season. One lock will be just below Arnhem at Doorwerth; the second, downstream at Amerongen, and the third, farther downstream, at the village of Hagestein.

Because of the great flow of water to be carried away by the Yssel through the dam at Doorwerth, the bed will have to be lowered. Two large bends in the upper reaches of the Yssel will be eliminated so that the amount of bed to be lowered will be considerably shortened. An additional advantage will be the elimination of some awkward navigation areas and reduction of the distance ships have to travel.

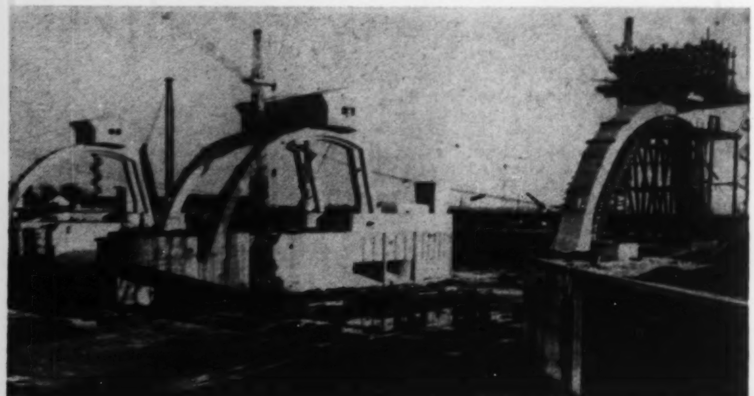
The dams at Amerongen and Hagestein will not affect the actual flow. Their job is to maintain the desired head of water, irrespective of the discharge in the Rhine. The navigable depth of the lower Rhine and the Lek will be increased from 5 ft to about 9 ft. Locks built adjacent to all three dams will be used only when the dams are closed. When the dams are open the ships will be able to pass through unhindered with 30-ft headroom.

The availability of adequate navigable depth at all times, plus a greatly reduced current in many cases, will enable shipping to travel faster upstream. Extensive model tests in connection with the project have been conducted at the Hydraulics Laboratory in the Northeast Polder. Construction began with the dam and lock at Hagestein and the works to the east. The flood of 1953 delayed the start of the project, but by 1954 work had begun on the excavation for the dam and lock at Hagestein.

Concrete work on the lock has already been finished, and will soon be completed on the dam. The Taintor gates are expected to be installed by the end of this year, and plans call for completing the remaining adjacent river works by the middle of 1961, so that it will be possible for the dam and lock project at Hagestein to be put into use later that year.

Excavation for the dam and lock at Amerongen is now nearing completion and contracts for concrete work for both structures will be awarded soon. Meanwhile, a start has been made on adjacent river works. Work is expected to begin at Doorwerth by the end of 1960.

The center pier will have a sluiceway that will regulate normal flow of the river. The project is expected to be completed by mid-1961.



EXAM GEMS

by Reggie Strashn

R. ROBINSON ROWE, F. ASCE

EXAMGEM No. 13 used branching pipes to split Michigan aspirants into skippers, doodlers, cutters and zippers. The same four types are common in California too, so let's see what they did.

Mr. Skipper diagrammed the layout (Fig. 1), with UY (36-in. by 10 mi) running from El. 200 to the wye, and YK (24-in. by 10 mi) and YL (30-in. by 15 mi) in parallel from the wye to El. 0. Then he skipped to greener grass.

Mr. Doodler added hydraulic grade lines UX, XK and XL, where X was the common grade point at the wye, at x ft above the lower reservoir. Then he doodled a blue porpoise in the lower lake, a green penguin climbing the pipeline, and a pink mermaid in the upper lake. The X became the dot of a great question mark, which expanded into billowing cumulus clouds from which lightning zigzagged to the penguin. A nice allegory, the penguin being the aspirant—a draftsman who couldn't make the grade.

Mr. Cutter began by choosing n = 0.012 for RC pipe in Manning's formula:

$$Q_o = 1.486\ AR^{2/3} S^{1/2} \quad\quad (1)$$

With S the only unknown, he assumed an elevation for X, computed the corresponding S for each pipe, and tested whether the flow in the branches matched the flow in the 36-in. pipe. Failing, he tried another X, and his cut-and-try solution was neatly tabulated like this; with answers underscored:

Trial X	Flow in pipes, cfs 24"	30"	Total	36"
100	10.7	15.8	26.5	31.4
110	11.2	16.5	27.7	29.8
120	11.7	17.3	29.0	28.1
117	11.5	17.1	28.6	28.6

Mr. Zipper used the same basic formula, but substituted $S = H/L$ and the values of A and R to derive a special formula for each pipe,

$$Q_{36} = 3.145\sqrt{200-x} \quad\quad (2a)$$

$$Q_{30} = 1.579\sqrt{x} \quad\quad (2b)$$

$$Q_{24} = 1.066\sqrt{x} \quad\quad (2c)$$

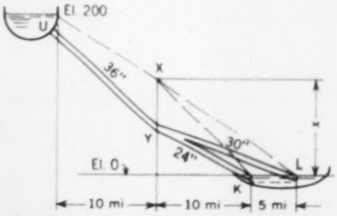


Fig. 1. Branch-pipe problems are usually cut-and-try, but this one can be done honestly.

He zipped right along without false steps, adding the last two and equating to the first for an easy equation in x:

$$2.645\ \sqrt{x} = 3.145\ \sqrt{200-x}$$

$$0.7078\ x = 200-x$$

$$x = 200/1.7078 = 117.11$$

$Q_{36} = 28.63$, $Q_{30} = 17.09$, $Q_{24} = 11.54$, Q_{24}

Looking back at the two solutions, we must agree that each is right and each is easy—that is, easy in the sense that the steps are simple if you know where you are going. Skipper and Doodler didn't. They probably looked in the book and were confused by talk of conveyance and equivalents. Forget these expedients unless you use them every day. Reduce the problem to a series of little problems, like Cutter did. If there will be several trials using the same formula in which several factors remain constant, combine them as Zipper did; see how easy it would be to compute Cutter's tabulation from Zipper's special formulae. However, if the data fit hydraulic tables, cut-and-try is the quicker and safer procedure.

The problem qualified as a "gem" because thinking men with basic skills could solve it like Cutter, specialists like Zipper could solve more directly, and neophytes with neither knowledge nor know-how were nixed.

EXAMGEM No. 14

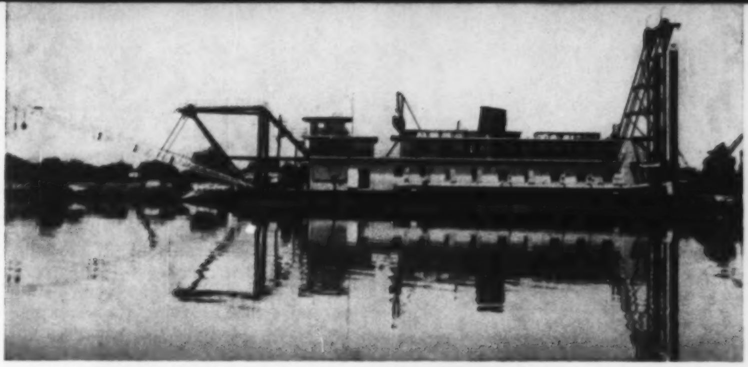
This 15-yr-old problem may not sound like civil engineering, but it was written as a simplified version of a floating bridge caisson.

A barge 20 ft wide by 50 ft long by 5 ft deep to top of bulwarks and displacing 100 tons, is required to lift a 5-ton load from an adjacent pier. How far can it boom out along its short axis without submerging the bulwark, with a 2-ton boom rigged to a light mast at the center of the barge?

Steel Contract for Bridge Bus Station

The Port of New York Authority announces award of the first major contract for the George Washington Bridge Bus Station. The $1,246,573 low-bid contract for furnishing and erecting 4,248 tons of structural steel for the $13,000,000 facility has been let to the Bethlehem Steel Company. The modern two-block-long, three-level station will feature a concrete roof designed by Dr. Pier Luigi Nervi, world-famous Italian engineer-architect. It will be Dr. Nervi's first project in the United States. Scheduled for completion in 1962, the station will straddle the depressed twelve-lane George Washington Expressway between Fort Washington and Wadsworth Avenues.

Fabrication of the steel will begin immediately for delivery this fall. Completion of steel erection for the bus station and the connecting bridges over Broadway and Fort Washington Avenue is expected by March 1961.



New Dredge Readied for Shipment to Brazil

Latest refinements in heavy-duty hydraulic pipeline cutterhead dredge design are incorporated in the "Parana," a new 24-in. hydraulic pipeline cutterhead dredge, built for the Republic of Brazil under a $5,500,000 contract for dredging machinery made by the Ellicott Machine Corporation, Baltimore, Md., with the National Bank for Economic Development. The mammoth floating excavator is 165 ft long and 42 ft wide, with digging depth of 46 ft. It has a maximum output of 2,100 cu yd per hour and can pump through pipelines up to 9,000 ft long. The "Parana" and other dredging equipment are being purchased by the Brazilian Government to undertake a widespread program of port development and maintenance. Sixteen harbors ranging from Belem at the mouth of the Amazon River to Rio Grande near the Uruguayan border are scheduled for rehabilitation by the dredging fleet.

Contract Let for Oil Wharf Job in Alaska

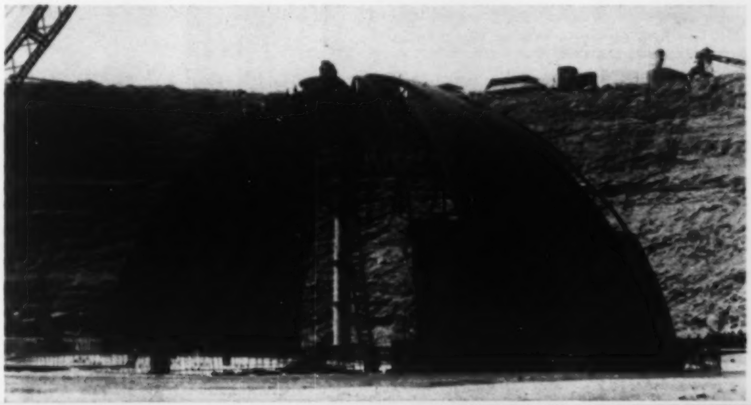
Construction of a deepwater wharf to serve as sea terminus for a 22-mile pipeline from a new oil field on Alaska's Kenai Peninsula has been awarded to a joint venture of J. H. Pomeroy & Co., Inc., and its wholly owned subsidiary Ben C. Gerwick, Inc. The $1,300,000 contract, now getting under way near the town of Kenai, is being performed for the Kenai Pipeline Company, an affiliate of the Standard Oil Company of California. The firm of Earl & Wright designed the wharf and supporting facilities.

The wharf will be 900 ft long, and will handle 28,000-ton tankers. A central breasting platform 250 ft long and 50 ft wide will be linked to shore by a 1,000-ft causeway with a 14-ft-wide roadway and 6-ft-wide pipeway.

Swift currents, 30-ft tides, and seasonal ice at the site make necessary unusually heavy supports for both wharf and causeway. Support will be provided by steel pipe cylinders ranging from 5 to 8 ft in diameter, and up to 110 ft in length. These cylinders will be driven about 40 ft below sea bottom, filled with compacted sand, and capped with concrete.

Housing for California Titan ICBM Missile Base

A new building concept to speed construction of the huge underground concrete domes required for housing Titan ICBM missile base operations has been developed by the Berkeley (Calif.) Steel Construction Company. The method utilizes fabricated shaped steel sections, which can be dismantled and used again at other bases. As shown in this photo taken at a new missile site at Beale Air Force Base in California, the inner steel forms resemble two curved, wedge-shaped sections supported by a center post. Concrete is poured between the two forms. After the concrete has set for six days, the outer forms are lifted off and the inner form is loosened and rotated on a track to an adjacent pouring position. The outer forms are then repositioned, and the units are ready for the next pour. The Beale missile base is being constructed for the Corps of Engineers by Peter Kiewit Sons' Company.



New in education

Honors program in science and engineering . . . .

The Ford Foundation has awarded a grant of $700,000 to the Polytechnic Institute of Brooklyn to establish an honors program in science and engineering for the exceptional student "whose full potential is not challenged adequately by the average college curriculum." Under the new program these students will be able to receive a doctorate in six years of full-time study—a reduction of from two to four years in the time it presently takes science and engineering students to receive doctorates. Although no strict dividing line is provided between undergraduate and graduate work, a bachelor of science degree will be awarded at the end of the undergraduate portion of the program. Already selected to take part in the new program in September are 33 members out of approximately 500 entering freshman.

Symposiums scheduled for early fall . . . .

Graduate engineers are invited to a symposium on aspects of reinforced concrete design being held at Queen's University, Kingston, Ontario, from August 29 through September 2. Intended to give practicing engineers and others the opportunity to become familiar with recent developments in ultimate load design and the design of shells, the lectures will feature three outstanding authorities. They are Prof. A. L. L. Baker, Dr. E. Hognestad, F. ASCE, and A. L. Parme, M. ASCE. Inquiries should be addressed to the Director of Extension, Queen's University, Kingston, Ontario, Canada.

A distinguished group of speakers will be present at Purdue University, November 15 and 16, for a symposium on engineering application of probability and random function theory. The purpose of the symposium is to bring to the research engineer and scientist current techniques and thoughts concerning practical application in these fields. Correspondence should be addressed to Prof. J. L. Bogdanoff, School of Aeronautical and Engineering Sciences, Purdue University, Lafayette, Ind.

Water supply and pollution control . . . . .

A three-day symposium (August 29-31), the first on the need for further development of automatic instrumentation for the measurement of water quality, is being sponsored by the Public Health Service at the Service's *Robert A. Taft Sanitary Engineering Center* and the Hotel Sinton in Cincinnati. The meeting is being arranged by personnel of the Sanitary Engineering Center and the Division of Water Supply and Pollution Control and will consist of 28 technical papers. The Public Health Service will also offer a two-week training course in "Plankton Analysis," October 24 through November 4 at the Center. Designed for personnel in the fields of water supply and limnology, the course provides laboratory practice in the identification and enumeration of algae and other organisms in water supply reservoirs, water treatment plants, and distribution systems. For information write to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office Director.

Fellowships—North, South, East and West . . . .

The 1961-1962 listings of U. S. Government Awards under the *Fulbright and Smith-Mundt Acts* offer a choice of programs in civil engineering and its allied fields. Programs in city planning, construction engineering, earthquake engineering, water research, and traffic engineering offer opportunities for study in such diverse countries as Austria, Belgium, China, Denmark, Finland, Japan, Norway, Turkey, UAR, and the United Kingdom. Applications will be accepted in any field whether or not a specific opening is listed in the announcement and should be mailed no later than October 1. Application forms and additional information obtainable from the Conference Board of Associated Research Councils, Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C.

A research fellowship in city planning has been established by Harland Bartholomew and Associates, internationally-known city planning firm, at the *School of Fine Arts of the University of Pennsylvania.* In addition to providing an opportunity for graduate study at the university, the fellowship will permit the recipient to spend a summer of research work in the headquarters office of the firm in St. Louis, Mo. According to Professor Robert B. Mitchell, chairman of the University's department of city planning, "This fellowship is the first such to be established by an American city planning firm in an American graduate department of city planning and is symbolic of the recognition by the profession of the need for expanding and assisting graduate training."

NSF graduate programs . . . .

Applications are now being accepted by the *National Science Foundation* in two graduate-level fellowship programs—Cooperative Graduate Fellowships for the academic year 1961-1962, and Summer Fellowships for Graduate Teaching Assistants for the summer of 1961—and in the Postdoctoral Fellowship Program. Under both graduate-level programs initial evaluation will be by local faculty committees of participating institutions, while Postdoctoral Fellows will be selected on the basis of ability as evidenced by letters of recommendation and other evidences of scientific attainment. Application materials may be obtained by writing to the Fellowship Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C.

CCNY administration to have modern quarters . . . .

Construction of a new $1,200,000 administration building for the City College of New York is scheduled to begin shortly. The building will consist of two full stories and a partial third story and will be modern in appearance, with a glass and aluminum facade over a reinforced concrete frame. Floor slabs for the 280-ft by 85-ft building will be of flat plated design. The structural engineers are Weiskopf & Pickworth.

Computers and engineers . . . .

A nationwide conference on the use of computers in undergraduate engineering instruction has been scheduled for September 12 and 13 at the University of Michigan, Ann Arbor. The conference—sponsored by the Ford Foundation—will be open to all engineering educators and interested persons in industry and government. For information contact Prof. Donald L. Katz, 2020A East Engineering, University of Michigan, Ann Arbor, Mich.

Masters in highway engineering . . . .

A full program of graduate studies with a major in highway engineering leading to the degree, Master of Civil Engineering, is now available at the *Catholic University of America.* Persons employed locally who wish to continue their studies on a part-time basis will find that courses are conveniently scheduled for the early evening. Catalogues and applications for admission are available through the Registrar, while requests for more detailed information should be addressed: Head, Department of Civil Engineering, the Catholic University of America, Washington 17, D. C.

Highway safety . . . .

The Traffic Institute of Northwestern University at Evanston, Ill., has received a $58,000 grant from the Automotive Safety Foundation to carry on its 1960 program of training, field service, research, and publications in the street and highway safety field. The ASF was a major factor in the Institute's founding in 1936 and has remained one of its principal supporters.

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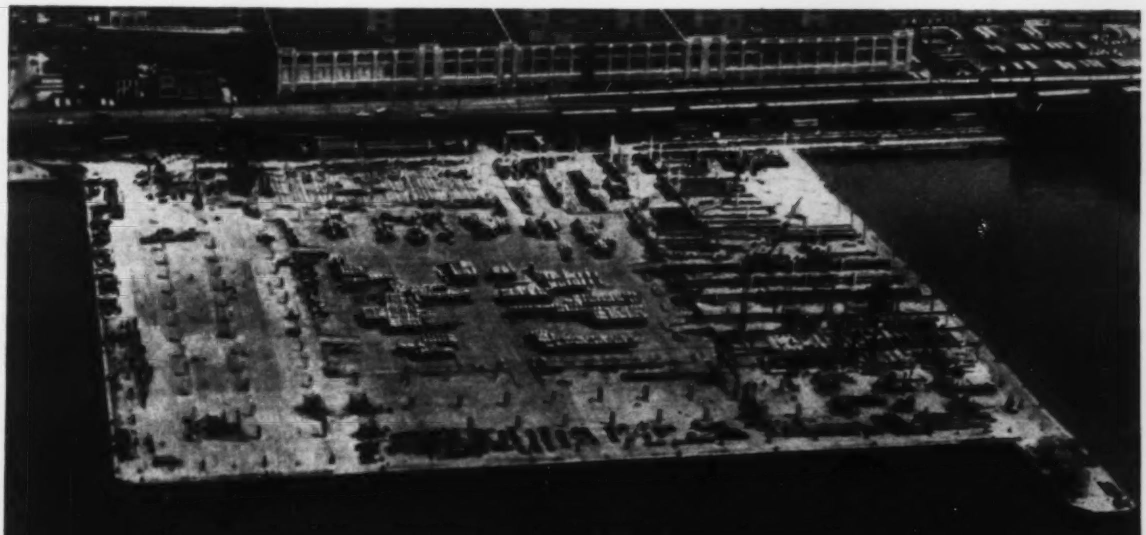

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Lamar Pipe & Tile Division, American-Marietta Company, Grand Rapids—Pipe Manufacturer

L. W. Edison Company, Grand Rapids, Michigan—Contractor

USS American Welded Wire Fabric conforms perfectly to the elliptical shape of the 144" pipe. Because of the machine prefabricated accuracy of USS American Welded Wire Fabric, cages can be formed faster, and the spacing and concentricity of cages can be accurately controlled.

strengthen concrete pipe on Michigan Highway job

The Michigan State Highway Engineers faced a problem when it came to the selection of pipe for an important new highway in Berrien County. Hydraulic and grade line considerations dictated pipe with maximum water-carrying capacity with a low flow line, but with up to 33 feet of back fill. They selected over 1,000 linear feet of elliptical, reinforced concrete pipe. Diameters varied from the smallest to the largest—18" to 144".* Lamar Pipe & Tile Division, American-Marietta Company, manufactured the pipe.

In the case of the 480 feet of 144" required to withstand 33 feet of backfill, the specifications required 3 lines of reinforcement—an inner and outer cage each having 0.754 square inches per foot, and an elliptical cage having an area of 1.508 square inches per foot. Lamar Pipe & Tile elected to use American Welded Wire Fabric on this big job.

Concrete pipe manufacturers insist on quality reinforcing, meeting rigid specifications—that's why so many of them use USS American Welded Wire Fabric. This quality product—with its machine-made accuracy, assures the proper distribution of steel because the wire diameters are held to the close tolerance of ±0.003" and their spacing may not vary by more than ¼" center-to-center. This prefabricated product is more accurate than other forms of reinforcing. Its cold-drawn, high-tensile steel wires have a minimum yield point of 60,000 psi and a minimum ultimate strength of 75,000 psi. For more information, write to American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

*Round equivalent

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DECEASED

Jack R. Braks (J.M. '54; A.M. '59), age 28, a 1954 civil engineering graduate of Northeastern University, died recently in Arlington, Mass. In the past six years he was successively a detailer with the American Bridge Division of the United States Steel Corporation in Gary, Ind.; a designer with Jackson & Moreland, Inc., of Boston; and structural designer with Melvin F. H. Jay, also of Boston.

Ernest Edmund Brydone-Jack (M. '08; F. '59), age 88, died recently in Joshua Tree, Calif. Mr. Brydone-Jack contributed significantly to developing the virgin areas of Canada while superintending engineer of Public Works of Canada for the Prairie Provinces, British Columbia, the Northwest Territories and the Yukon from 1917 to 1934. Prior to 1917 he taught engineering, serving as professor and dean of civil engineering at the University of New Brunswick; as professor at Dalhousie University, Nova Scotia; and as professor at the University of Manitoba.

Francis Winfield Collins (A.M. '10; M. '59), age 81, former president of the Ridgefield Water Supply Company, died in Ridgefield, Conn., on June 10. He retired in 1956 after more than 25 years as president of the Ridgefield concern; 14 years (1917-1931) as president of the Roanoke (Va.) Water Works Company; and 5 years (1925-1930) as president of the South Bay Consolidated Water Company of Long Island, N. Y.

Harry B. Fenton (M. '55; F. '59), age 67, since 1944 president and majority stockholder in the Fenton Construction Company, Ashland, Ohio, died there recently. His early professional experience included ten years as operating partner of the Ohio Improvement Company in Columbus, during which time he specialized in building asphalt roads, and ten years as part owner of the Sarnia Bridge Company, Ltd., of Ontario, Canada, which he served as vice president and manager.

Vladimir G. Frisk (M. '49; F. '59), age 62, a civil engineer with the General Electric Company since 1925, died in Schenectady, N. Y., on May 26. A Russian by birth and graduate of the St. Petersburg Institute of Engineers, Mr Frisk joined General Electric shortly after coming to the United States.

Thomas Devin Harris (A.M. '21; M. '59), age 70, for more than 30 years bridge engineer in charge of construction in the Washington, D. C., area for the U.S. Bureau of Public Works, died recently in Arlington, Va. Before joining the Bureau Mr. Harris had a consulting practice in Marion, N. C., from 1923 to 1928.

Elmer R. Hicks (A.M. '42; M. '59), age 61, for the past nine years chief engineer of the McCloskey Company, of Pittsburgh, Pa., died recently in Glenshaw, Pa. He joined the firm in 1951 after several years as tower engineer and then general engineer with the Blaw-Knox Company, and one year as chief engineer of the Cementstone Corporation. While with Malcomson, Higginbotham & Trout in the early 1930's, Mr. Hicks did most of the design of the 11-story Elk's Temple in Detroit.

Howard E. Hyde (M. '11; F. '59), age 83, for 25 years vice president and manager of the New York City firm, Young & Hyde, Inc., died in New York recently. Other professional experience included several years as assistant engineer, city engineer and member of the municipal board of Manila; seven years as principal assistant engineer in charge of design and construction of sewage and drainage works for the city of Havana, Cuba; and two years as civil engineer on construction of drydocks and buildings at the Brooklyn (N. Y.) Navy Yard.

Burns Lafferty (A.M. '30; M. '59), age 58, owner of the Philadelphia consulting firm bearing his name, died recently in Philadelphia. Before founding his own firm in 1951, Mr. Lafferty was for many years president of the Lafferty Paving Company and superintendent of construction with Harris Gramm, Inc., both of Philadelphia.

Charles D. Loveland (A.M. '18; M. '59), age 71, from 1912 until his retirement a few years ago on the staff of the Truscon Steel Company, in New York, died recently in Nassau in the British West Indies. Mr. Loveland had served as manager of the Pittsburgh District; as vice president in charge of the New Jersey District and, since 1937, as eastern district manager at headquarters in New York.

David N. Milhan (A.M. '20; M. '59), age 67, retired civil engineer of Pueblo, Colo., died there on June 20. From 1926 to 1950 Mr. Milhan was superintendent

(Continued on page 128)

ANNOUNCING

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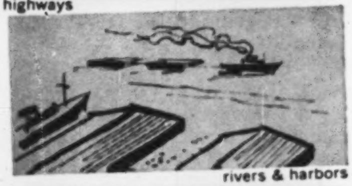
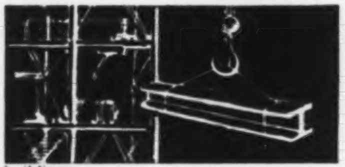
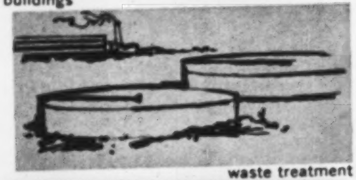
highways

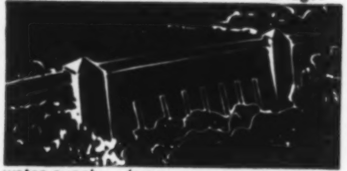

rivers & harbors


buildings

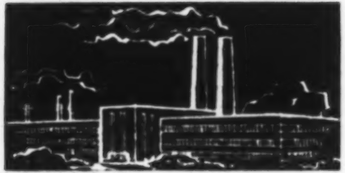

waste treatment

pipelines

bridges


water supply — dams

airports


industrial plants

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As a result of this wide responsibility, civil engineers largely control the specification and purchase of construction equipment, materials and services.

The only magazine edited exclusively to serve the technical, business and professional needs of this select audience is CIVIL ENGINEERING... official publication of the American Society of Civil Engineers.

Year after year, its circulation has increased with construction activity and the growth of the civil engineering profession. Editorially CIVIL ENGINEERING serves all areas of construction and all civil engineering interests – making it truly The Magazine of Engineered Construction.

Basic data on the civil engineer's role in different construction industry groups is being furnished by A.S.C.E. Mail Forum surveys. For example, the most recent study (of consulting engineers) revealed these facts:

- CIVIL ENGINEERING's consultant readers own or work for firms that concentrate almost entirely on *engineered construction* projects...with their work divided among the various types of construction as follows:

Airports	3.8%	**Military sites**	3.9%
Bridges	7.6	**Pipe lines**	4.6
Buildings, commercial & residential	17.9	**Rivers & harbors**	1.6
Dams	2.7	**Waste treatment**	10.9
Highways & streets	14.6	**Water supply**	10.1
Industrial plants	9.1	**Miscellaneous**	13.2

- the average annual cost of all the equipment and materials specified by each of the 290 firms reported is well over $6 million.
- 90% of the readers influence the purchase and the specification of construction materials, installed equipment and office equipment.
- their titles and functions are proof of a high degree of authority and a wide area of buying influence within their firms.

In CIVIL ENGINEERING, advertisers reach top quality consultants concerned only with construction. This is the core of your consulting engineer market... the men who specify your products!

And remember...whether your product is specified and purchased through consultants, contractors, architects, owners, public works officials (or any combination of these groups) you get the *most effective, most economical* coverage of civil engineers by advertising in CIVIL ENGINEERING Magazine.

Quality circulation guarantees that your product message will be concentrated on men who make the decisions that lead to purchases!... which is why we say, "advertising in CIVIL ENGINEERING stimulates sales in construction markets."

ABC 45,000

CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION

The American Society of Civil Engineers ■ 33 W. 39th St., New York, N. Y.

ESSICK
VIBRATING COMPACTORS

ESSICK VR-72 VIBRATING COMPACTOR
COLTON-RIVERSIDE FREEWAY—CALIFORNIA

SAVED $2,400 PER MONTH IN RENTAL
CUT COMPACTION COST.....
...FROM 9¢ TO 2½¢ PER YARD

E. L. Yeager Co., Altfillisch Const. Co., and Lowe and Watson (Joint Venture) "On the Colton-Riverside Freeway, compaction requirements were 90% of California AASHO on fill material made up of silty clay with occasional sand strata. We had been compacting 12,000 yards per 9 hour day for as high as 9¢ per yard with both a 75 ton and a 50 ton pneumatic tired roller, and two 5 x 5 sheepsfoot rollers pulled by D-8 Cats.

"We replaced the pneumatic rollers, sheepsfoot rollers and a D-8 with the Essick 72" VR-72-T Vibrating Compactor and compacted 8,000 cubic yards in a 9 hour day with the single roller, and cut our compaction cost to as low as 2½¢ per yard. We saved $2,400 per month in rental alone and were able to meet or better the 90% specs in one pass*.

HIGH-FREQUENCY VIBRATION

"With our previous equipment, moisture had to be 11 - 12% or we did not meet some of the compaction tests. With the Essick VR-72, moisture content was not critical as we met the specs with moisture as little as 6 - 7%. The Essick VR-72 Vibrating Compactor was a big help in making this a profitable job for us."

* ESSICK HIGH-FREQUENCY VIBRATING COMPACTORS ARE CUTTING THOUSANDS OF DOLLARS DAILY FROM CONTRACTORS' COSTS! ASK FOR PROOF.

SEE YOUR ESSICK DEALER NOW FOR A DEMONSTRATION

9 models of Vibrating Compactors from [illegible] to 72" widths

for compacting all types of fills, sub base, base materials, asphalt, and trenches

ALSO 14 MODELS OF TANDEM ROLLERS FROM 1/2 TO 14 TONS

ESSICK MANUFACTURING COMPANY

1950 Santa Fe Avenue
Los Angeles 21, California

850 Woodruff Lane
Elizabeth, New Jersey

Affiliated with THE T. L. SMITH CO., Milwaukee, Wisconsin

Deceased

(Continued from page 126)

of the construction and yard department at the Minnequa Plant of the Colorado Fuel and Iron Corporation. Earlier he supervised the design and construction of the Marston Lake Filtration Plant in Denver, Colo.

Frederick L. W. Moehle (M. '42; F. '59), age 56, for the major part of his career head of F. L. W. Moehle and Associates, Baltimore, Md., consulting engineers and architects, died recently in Baltimore. Mr. Moehle had also served as principal assistant engineer and chief architect with the late W. S. Austin, and as a partner in the firm of Zink & Moehle.

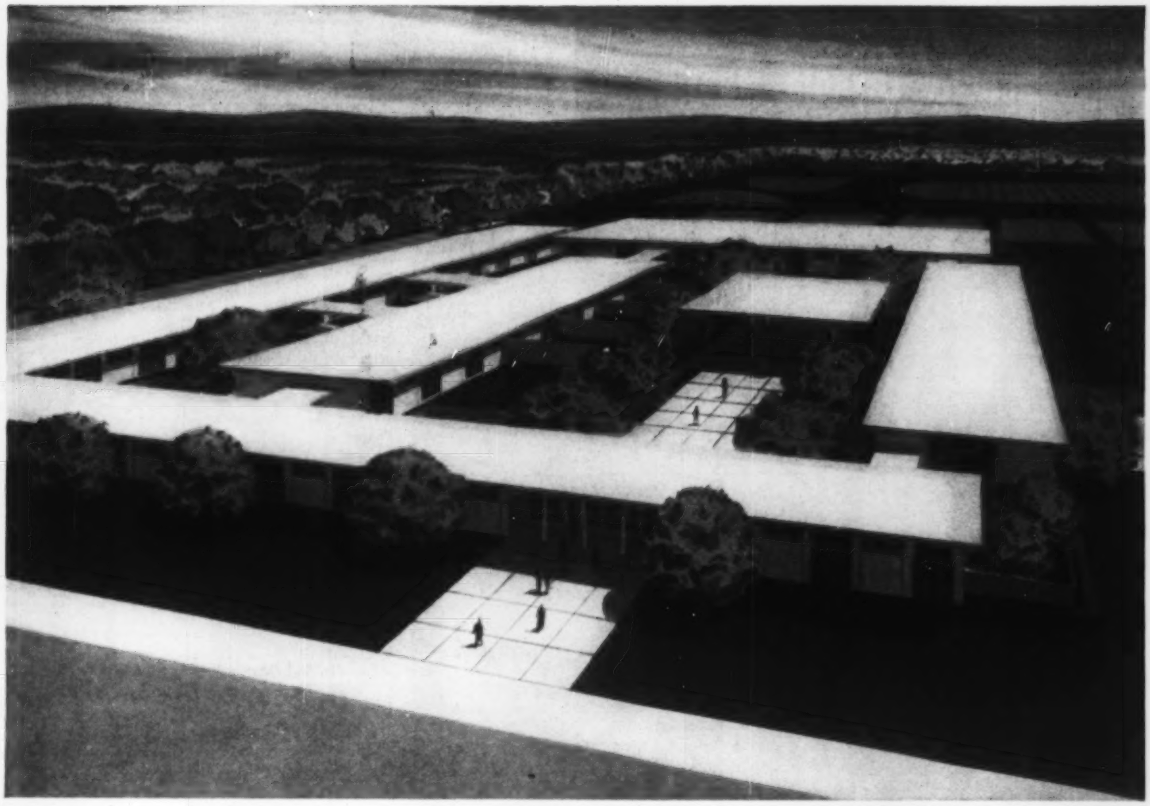
Marvin Edward Roberts (A.M. '39; M. '59), age 53, for 20 years a civil engineer for the Tulsa District of the Corps of Engineers, died on May 26 in St. Louis, Mo. Mr. Roberts had also worked in the Corps' relocation department supervising preparatory operations of areas scheduled for federal reservoirs.

Lloyd Brown Smith (M. '12; F. '59), age 91, former city commissioner of Topeka, Kans., died there on July 4. In 1935, after many years as chief engineer of the Topeka Bridge Company, Mr. Smith was elected water commissioner. Under his guidance during his nine consecutive terms in office, the present city water system was developed.

Charles William Snyder (A.M. '48; M. '59), age 55, since 1951 senior assistant sanitary engineer in the Maryland State Department of Health, died recently in Baltimore, Md. Prior to his appointment to the State Department of Health Mr. Snyder was research associate in sanitary engineering at Johns Hopkins University.

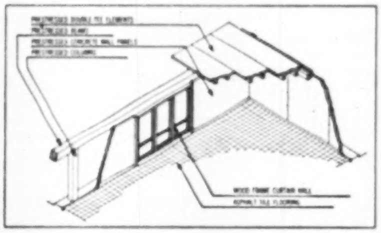
Albert Stevenson (M. '41; F. '59), age 70, a partner in the New York consulting engineering firm of Seelye, Stevenson, Value & Knecht, died in New York on May 26. Mr. Stevenson, who had been with the firm since 1913, had recently been helping prepare a report sponsored by the State Division of Housing on methods of reducing the cost of public housing. His projects included the Grumman Aircraft plants at Bethpage and Calverton, Long Island, N. Y., and the Wallington Tube Corporation Plant at Wallington, N. J.

Emil F. Vranich (J.M. '48; A.M. '59), age 36, of the consulting engineering firm of Emil F. Vranich and Associates, Inc., of Milwaukee, Wis., died recently in Milwaukee. Mr. Vranich was formerly structural engineer in the City of Milwaukee Bureau of Bridges and Public Buildings, president of Collings-Vranich and Associates, Inc.; and vice president and structural consultant of Robert J. Strass, Inc.



Architects and Engineers: Reid Rockwell Banwell and Tarics, San Francisco; *Prestressed Concrete Fabricator:* Basalt Rock Co., Napa, California.

PRESTRESSED CONCRETE CALIFORNIA SCHOOL QUALIFIES FOR STATE AID



...BROUGHT IN AT $30,000 UNDER ALLOWABLE BUDGET

This is the Mango Avenue Intermediate School, Sunnyvale, California. It has met the requirements for low-budget schools as determined by the Department of Finance, State of California. Heretofore, 90% of the schools that have met this requirement were constructed mainly of wood.

Simplification of the structural elements helped, in large measure, to bring this structure within the requirements for state aid. Basically, the structural elements consist of prestressed concrete beams, columns, wall panels and double-tee roof sections (see isometric detail above).

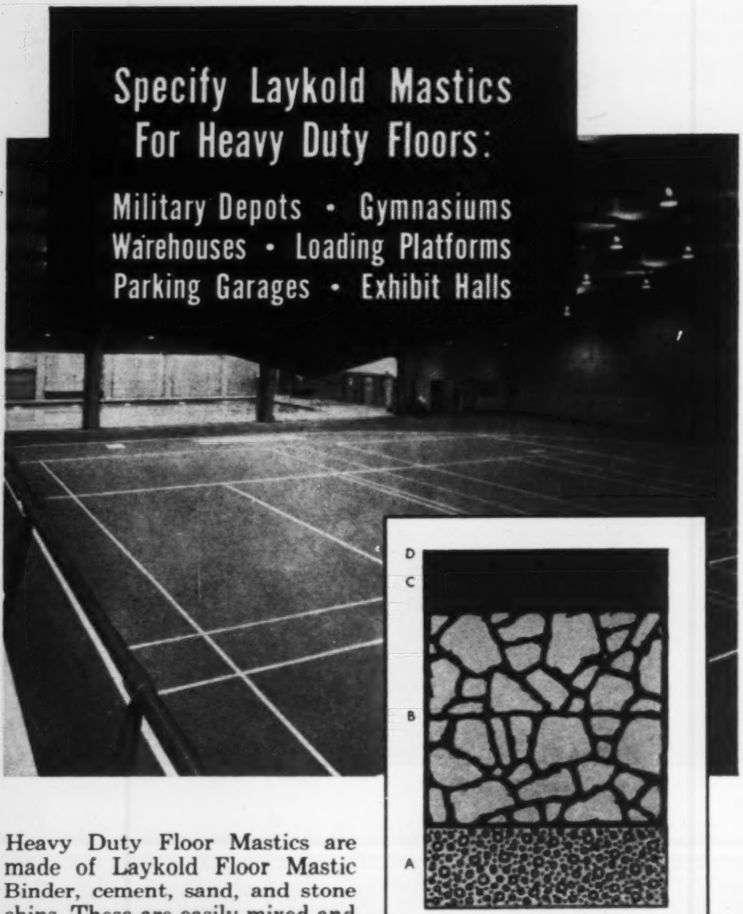
At the moment, the school is equipped to handle some 660 7th and 8th grade pupils. Provision has been made to expand the plant to accommodate the 9th grade, bringing the total population to approximately 1000 pupils.

Here, briefly, are some of the client's instructions that were met by choosing prestressed concrete: Comply with state aid limitations; allow for future expansion; provide for low maintenance.

The benefits brought to this structure by prestressed concrete can be applied to almost any kind of structure you can name. This includes garages, motels, office buildings, piers, bridges, plants and warehouses. For other purposes, "State Aid" can be translated into low-cost initial investment, a characteristic of prestressed concrete for *any* structure.

Roebling has played a significant role in the development and promotion of prestressed concrete; in the manufacture of the finest wire and prestressing strand available and in the compilation of data on design methods and tensioning techniques. We will be happy to share this experience and information with you. May we suggest that you contact the prestressed concrete fabricator in your area or write Roebling's Construction Materials Division, Trenton 2, New Jersey.

ROEBLING
Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



Specify Laykold Mastics For Heavy Duty Floors:

Military Depots • Gymnasiums
Warehouses • Loading Platforms
Parking Garages • Exhibit Halls

Cross-section View of a Typical On-grade Laykold Mastic Floor

A—2" sub-base of compacted crushed gravel.
B—5" of Bitumuls Penetration Macadam placed in two lifts.
C—2" of Laykold Mastic placed as 1½" leveling course; ½" surface course.
D—Wearcoat Finish; Colorcoat Seal (choice of colors: red, green, black).

Heavy Duty Floor Mastics are made of Laykold Floor Mastic Binder, cement, sand, and stone chips. These are easily mixed and screeded into place; hard-trowelled to a dense, smooth surface; and cured to a hard, durable finish.

"Bonus Benefits" of Laykold Mastic Floors:

- No dust or spalling normally associated with concrete
- Resilient, warm, water-resistant, and easy on the feet
- Easy to maintain and repair

For on-grade construction Laykold Mastic Floors are often "built from the ground up". One recent example: the Field House floor specified and built for the Waukesha, Wisconsin, High School, shown above.

This floor, Bitumuls Penetration Macadam construction, has a Laykold Mastic surface, Wearcoat finish, and a "two-tone" Colorcoat seal (in green and red). They use it for a full program of athletics; plus auto, stock, and home shows.

Laykold Mastics are also used to surface concrete floors and as underlayments for floor tile.

There's a Laykold Mastic Floor to meet industrial, commercial or institutional needs. Call us for "typical specs".

American Bitumuls & Asphalt Company

320 MARKET, SAN FRANCISCO 20, CALIF.
Perth Amboy, N. J.
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Oakland 1, Calif.
Inglewood, Calif.
San Juan 23, P. R.

BITUMULS® Emulsified Asphalts • CHEVRON® Paving Asphalts • LAYKOLD® Asphalt Specialties • PETROLASTIC® Industrial Asphalts

Positions Announced

San Diego County. The Surveyor's Office and Public Works Department has six immediate openings on a permanent basis for experienced Civil Engineers at approximately $749 to $825 per month. There is also an opening for a Principal Civil Engineer (approximately $954-$1,052 per month) in the engineering division of the Public Works Department. General requirements for all positions include U.S. citizenship or intention to become a citizen, the equivalent of graduation from an accredited four-year college with a major in civil engineering, and from three to five years of civil engineering experience. Dead line for applications is August 11. For further information write to the San Diego County Department of Civil Service and Personnel, Room 403, Civic Center, San Diego 1, Calif.

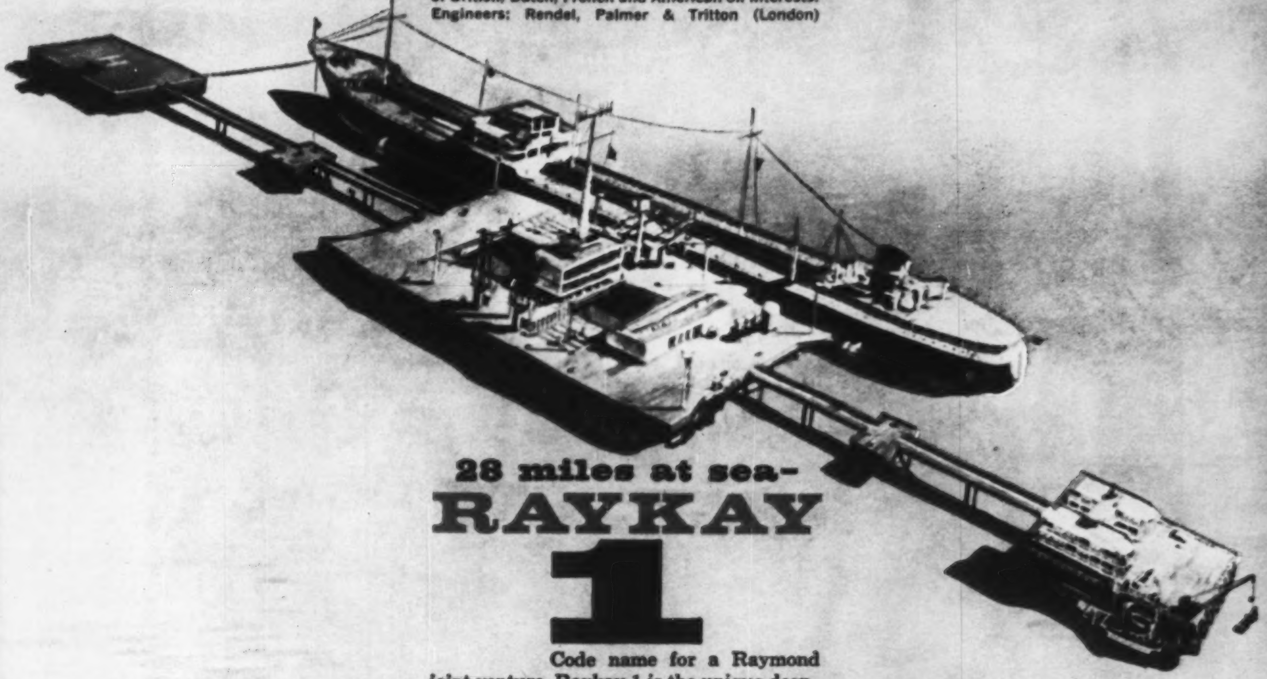
United Nations Educational, Scientific and Cultural Organization (UNESCO). The position of program specialist in the Division for Technological Sciences, Department of Natural Sciences, Secretariat of UNESCO, is open to an engineer who has a recognized engineering degree from a university or technical institute in the field of mining and civil engineering, with several years' experience in university teaching, and practical knowledge of industry related to his specialty. A good knowledge of English and a working knowledge of French are a must, while experience with the general conditions existing in underdeveloped countries and knowledge of their scientific needs is an asset. The salary is $7,300 per annum, net after Federal income tax and is supplemented by cost-of-living, dependency, education, and travel allowances. Please contact Paul R. Serey, Staffing Management Officer, Office of International Administration, Department of State, Washington 25, D.C.

Applications for Admission to ASCE, May 28-June 25, 1960

Applying for Member

RAVINDRA KUMAR AGRAWAL, Uttar Pradesh, India
NESET AKMANDOR, Ankara, Turkey
MOUNIR BADIR, Alexandria, Egypt
NORMAN DALE BAUMGART, Helena, Mont.
KENNETH A. BEEDE, JR., Emeryville, Calif.
BRICE FRANKLIN BENDER, JR., Lafayette, Ind.
CYRIL JOHN McDONALD BEST, Queensland, Australia
OTTO HANS WALTER BLUME, Fullerton, Calif.
GLENN ALVIN BUSTRUM, Los Angeles, Calif.
MILDRED BUTLER, Anchorage, Alaska
MANUEL DEJESUS CAMPOS NAVARRO, Ciudad Trujillo, Dominican Republic

(Continued on page 132)



Built for the Basrah Petroleum Company, a group of British, Dutch, French and American oil interests. Engineers: Rendel, Palmer & Tritton (London)

28 miles at sea–
RAYKAY
1

Code name for a Raymond joint venture, Raykay 1 is the unique deep-water oil loading depot now being built 28 miles offshore in the Persian Gulf. It is scheduled for completion about March 1961, and is designed to speed Iraq's oil exports by eliminating congestion at the port.

A $15,000,000 project

This great terminal literally took off eight months ago, when it floated out from England behind a towline that would eventually carry it 7,000 miles to its final berth.

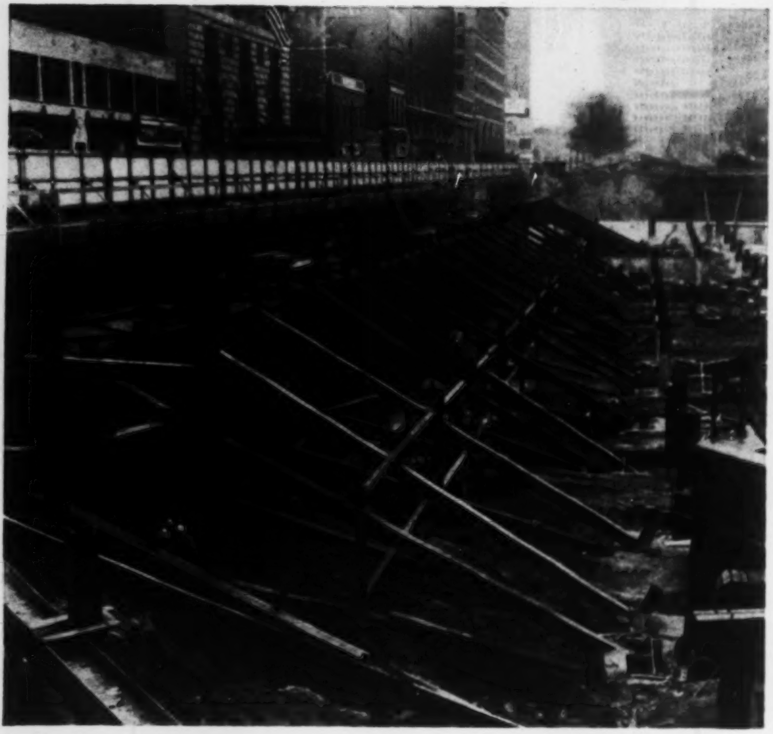
Twelve hundred feet long and complete with heliport and air conditioned crew quarters, Raykay 1 will be linked to Fao, its source of supply, by two 32-inch submarine pipelines. Two 65,000-ton tankers at a time will be able to load without having to navigate the shallow waters of the river leading to the present port. And the creative engineering of Raymond International is helping to make this possible.

Whatever your offshore problems, no matter how deep or distant, take advantage of Raymond's experience in many seas, in many parts of the world. We have the knowledge and the equipment, and we'd like to help. Write or call any of Raymond's offices throughout the world.

RAYMOND
INTERNATIONAL INC.

140 Cedar Street, New York 6, New York
Branch offices in the principal cities of the United States. Subsidiaries in Canada, Central and South America and other countries around the world.

Foundations For The Structures Of America
Complete Construction Services Abroad



ANOTHER PROBLEM SOLVED BY SPENCER, WHITE & PRENTIS

ALTERNATE BRACING, NO WALERS

Unique way to use timber sheeting for bank support and back form proves both practical and economical

Project: Military Park Underground Parking Garage, Newark, N. J.
General Contractor: Terminal Construction Corp., Wood-Ridge, N. J.
Consulting Engineers: Weiskopf & Pickworth, New York City
Architects and Engineers: Frank Grad & Sons, Newark, N. J.

In the above-pictured installation of horizontal wood sheeting, the braces are positioned at every second soldier beam. Ordinarily such alternate bracing would require walers; instead, this special design successfully substituted a system of tensioned struts and angles.

Without any encumbering walers, the sheeting served perfectly as a back form—after it had supported a trench (which was needed to relocate an existing sewer line) and had also maintained the street as the contractor excavated 36 ft. to subgrade for the main structure.

The special plan—by Spencer, White and Prentis—proved both practical and economical. Can we be of service to you?

CATALOG ON REQUEST

Spencer, White & Prentis INC.

FOUNDATIONS · PILING · UNDERPINNING · SHORING · COFFERDAMS · SPECIAL SERVICES

10 EAST 40th STREET, NEW YORK 16, N. Y.
DETROIT: 2033 PARK AVE. • CHICAGO: 221 NORTH LaSALLE ST. • WASHINGTON, D. C.: TOWER BLDG.

Applications

(*Continued from page 130*)

Luis Gonzaga Cardenal Arguello, San Salvador, El Salvador
Emil Harvey Carlson, Santa Monica, Calif.
Willima Sellew Chapin, New York, N.Y.
Francisco Carrillo Conde, Mexico, D. F. Mexico
Walter Francis Conlin, New York, N. Y.
Newton Kui Shin Chinn, San Francisco, Calif.
Frederic Anthony De Lory, Toronto, Ontario, Canada
William Archie Edwards, Baltimore, Md.
Robert Lathrop Fuller, Evanston, Ill.
Robert Harris Gallaher, Jr., Salt Lake City, Utah
Leslie Richard Groves, Stamford, Conn.
Henry Victor Hahne, Santa Clara, Calif.
Karl Friedrich Henke, Stuttgart, Germany
Carson Harper Hodge, Dallas, Tex.
Douglas Ford Horstman, Baltimore, Md.
Kou-Ying Hsiung, Taiwan, China
Guy LaMar Hubbs, Anchorage, Alaska
James Raymond Hufnagel, New York, N.Y.
Joseph Weldon Hunnicutt, Fort Worth, Tex.
Alfred H. Hunter, Jr., Mariemont, Ohio
Shih-Chieh Hwang, Taiwan, China
Arthur Montague James, Portland, Ore.
Joseph Wesley Karban, Havertown, Pa.
Tung Hua Lin, Los Angeles, Calif.
Cesar Jimenez Lopez, Mexico D. F., Mexico
Harold Coxley Lacy, Crescent City, Calif.
Iury Louis Mattin, Pullman, Wash.
William Allen McLendon, Camden, N. J.
John Alexander McPherson, Jr., Greenville, S. C.
Clinton Warren Mehring, Quito, Ecuador, South America
Guy Roberts Miles, Jr., St. Louis, Mo.
John Vinton Miller, Jr., Bryn Mawr, Pa.
Frank Mitchell, Jasper, Ala.
Harry Cranford Nelson, Mobile, Ala.
Horace Roy Oakley, London, England
Leroy Edward Olson, Youngstown, Ohio
Morris Masimo Peira, Hillsborough, Calif.
Jack Wilson Pepper, Jackson, Miss.
Howard Wilson Penney, Tulsa, Okla.
Usha Ram Sainani (Mrs.), Montreal, Quebec, Canada
Elmer Henry William Sandhaus, Rolla, Mo.
Ivan Raymond Skoglund, Hartford, Conn.
Leonard John Snell, Carson City, Nev.
Suha Somer, Ankara, Turkey
Robert Alexander Spence, Vancouver, B. C., Canada
Ramnath Narayan Swamy, N. Nigeria, West Africa
Guy Lee Sweet, Miami, Fla.
James Sidney Thompson, Oklahoma City, Okla.
Seferino Augustin Troncoso, Kansas City, Mo.
Wah Hin Tseng, Sarawak, British Borneo
Frank John Unversaw, Indianapolis, Ind.
Leslie Warren Waters, Roscoe, N. Y.
Paul William Welty, Bishop, Calif.
Robert Louis Wiegel, Berkeley, Calif.
Aryeh Michel Ytshar, New York, N. Y.
Jack Edward Zimmerman, Los Angeles, Calif.

Applying for Affiliate

Russell Andrew Pyros, Beverly Hills, Calif.

Applying for Associate Member

Siyanbola Mofunluke Aderisi Aderemi, London, England
Alfred Edward Cannon, New York, N. Y.
Dale Carl Carter, Los Angeles, Calif.
Ahmet Fahrettin Celik, Ankara, Turkey
James Patrick Coulon, Chicago, Ill.
Donald John Duffy, Groton, Conn.
Gerhard Everwyn, Cape Town, South Africa
Tso-Hsiong Fann, Washington, D. C.
Gurcharan Singh Gill, Nairobi, Kenya
William Alvis Hager, Council Bluffs, Iowa
Laurence Robert Hall, Urbana, Ill.
Alvaro Henao, Colombia, South America
Joseph Burton Hannon, Sacramento, Calif.
William Wesley Gale Hickenbottom, San Luis Obispo, Calif.
Wendell Alfred Higgins, Boise, Idaho
Onza Eugene Hyatt, McClellan AFB, Calif.
Thomas Beam Mon, New York, N. Y.
Napoleon Morua Carrillo, San Jose, Costa Rica
Birendra Nath Neogy, Madison, Wis.
Taichi Larry Nishihara, Los Angeles, Calif.
Robert Lewis Ohman, Minneapolis, Minn.
LeRoy Edward Phillips, Ames, Iowa
Donald Henry Pollock, Lafayette, Ind.
Durga Pada Ray, Ithaca, N. Y.
Everaldo Antonio Roa del Rosario, Ciudad Trujillo, Dominican Republic
Donald Charles Rose, Berkeley, Calif.
Eldon James Sayer, Milwaukee, Wis.
Eugene Albert Seline, Tulsa, Okla.
Jerrold Chartres Turner, San Francisco, Calif.
Richard Alexander Vinchesi, New York, N. Y.
Jaques Philippe Wolfner, New York, N. Y.

[*Applications for the grade of Associate Membership from ASCE Student Chapter Members are not listed.*]

THEY USED IT HERE . . . *Bethlehem steel beams and columns, joists, and Slabform were chosen for Guidera & Goodman's 11-story Hackensack apartment after careful analysis of costs. From left to right: John Guidera, Ralph Solow, Dan Reed, and Leo Goodman. Erwin Gerber is the architect.*

HERE'S WHY NEW JERSEY APARTMENT BUILDER SAYS:

Steel construction saves time for the contractor

BECAUSE THEY LIKED IT HERE . . . *River View Towers, attractive, steel-framed apartment in Fort Lee, N. J., has balcony views of the George Washington Bridge.*

For the 10-story River View Towers in Fort Lee, N. J., Guidera & Goodman of Englewood used steel all the way up—steel frame, open-web joists, solid steel centering (Bethlehem Slabform).

"Steel gave us complete maneuverability," said the builders. "No schedule delays, no waiting for good weather, no formwork. We knew which crews to schedule and when. No lost time sitting around."

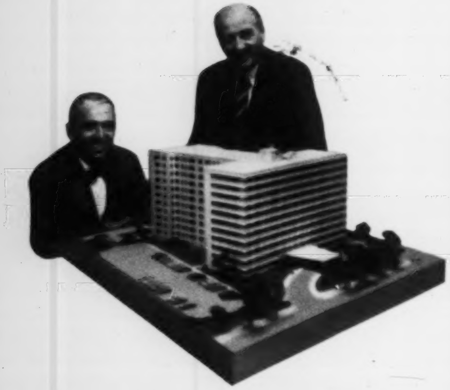
And after careful cost analysis, and comparison with other materials, Guidera & Goodman scheduled their new 11-story Hackensack apartment for the same steel construction.

Steel

for strength
. . . economy
. . . versatility

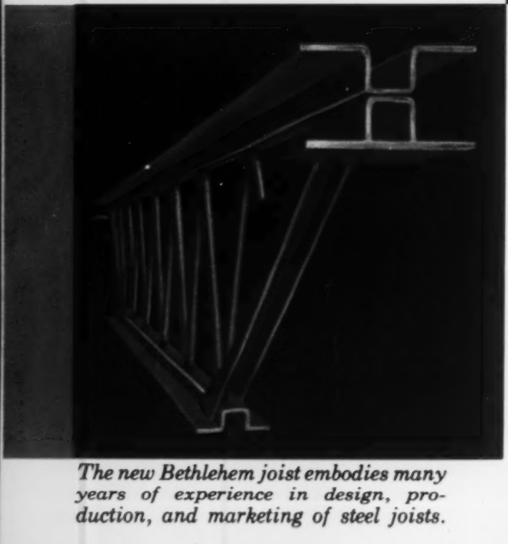
BETHLEHEM STEEL

BETHLEHEM STEEL



Contractors like Steel Open-web Joists because

- They arrive at the job site, *on schedule*, fully fabricated, marked, ready for immediate and easy placing.
- Field-welding secures them firmly in place.
- Conduit, pipe, ductwork can be run through the open-webs in any direction. No drilling or complicated angle-work in narrow corners.
- All the accessories . . . bridging, end-wall anchors, ceiling extensions, etc. . . . are supplied with them.



The new Bethlehem joist embodies many years of experience in design, production, and marketing of steel joists.

The eleven story apartment at Hackensack is completely steel-framed including Bethlehem open-web joists.

NEW BETHLEHEM "S" SERIES JOISTS WITH COLD-FORMED CHORDS

The newest member of the Bethlehem family of joists is an "S" series joist using cold-formed top and bottom chords. Cold-forming of the chords allows the metal to be placed in the best position for sustaining loads. It provides additional strength due to cold-working of the chord sections, increasing both the safety factor and resistance to damage in handling. Wide, flat-surfaced chord members offer excellent bearing area for the support of centering, subpurlins, precast plank, etc., and firm flat backing for ceiling lath. The new joist will be available this year.

BETHLEHEM STEEL

Here's why contractors like to work with SLABFORM

1. Roof slabs of lightweight insulating concrete can be poured over Slabform at support spacings much greater than the economical use of flexible centerings will permit.

2. Structural floor slabs poured over Slabform on steel beams often result in savings as much as one-third of the usual forming costs using conventional materials and methods.

3. Slabform provides a solid, safe working platform for all trades.

4. Slabform is tough—it readily takes normal construction abuse.

5. Properly attached, Slabform provides lateral restraint for supporting members and stiffens the entire assembly.

6. Heavy-Duty and Extra Heavy-Duty Slabform particularly can be furnished in special lengths longer than the standard lengths indicated.

Installing Slabform, Bethlehem's solid steel centering, on the fourth floor of the apartment building.

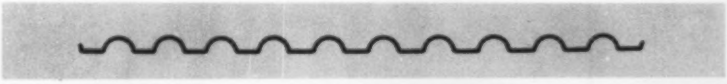
BETHLEHEM SLABFORM*

Slabform, Bethlehem's solid steel centering, is a high-strength, formed steel sheet used both as a permanent form for poured concrete and as a permanent supporting member for lightweight insulating concrete fills in roofs. Slabform is made from steel with a yield point testing consistently over 90,000 psi. Its longitudinal ribs give it exceptional strength.

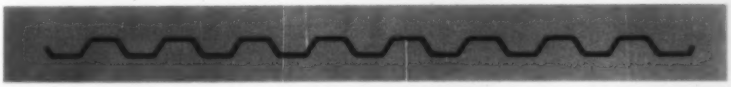
**Registered*

BETHLEHEM STEEL

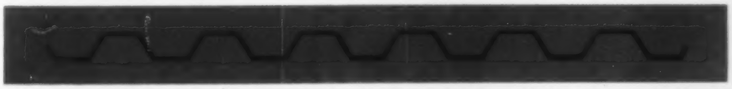
Bethlehem Now Makes Slabform in Five Gages



STANDARD SLABFORM Standard Lengths: **6'3", 8'3", 10'3", and 12'3"** **28 GAGE**



HEAVY-DUTY SLABFORM Standard Lengths: **6'0", to 18'6"** **26 GAGE**



EXTRA HEAVY-DUTY SLABFORM Standard Lengths: **6'0" to 21'6"** **24, 22, 20 GAGE**

STEEL CONSTRUCTION, *including Bethlehem Slabform, was used in constructing new Pier No. 7 in New York Harbor.*

A Complete Line of Construction Steel

The list of Bethlehem publications at the right is representative of those describing steel products for construction. To get those you want, just circle the number in the coupon below.

1. Open-Web Steel Joists
2. Slabform
3. Structural Shapes
4. The Welding of Concrete Reinforcing Bars
5. H-Piles
6. Sheet Piling
7. Steel Plates
8. Abrasion-Resisting Steels
9. Wire Rope for Construction Equipment
10. Wire Rope Slings and Fittings
11. Stress-Relieved Strand for Prestressed Concrete
12. Solving Drainage Problems (steel culverts)
13. Hollow Drill Steel
14. Rock Bolts
15. Steel Pipe
16. Highway Guard Rail
17. Building The Chase Manhattan Bank
18. News Bulletin—Fabricated Structural Steel

PUBLICATIONS DEPARTMENT
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

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BETHLEHEM STEEL

BETHLEHEM STEEL

RECENT BOOKS

(added to the Engineering Societies Library)

The American Civil Engineer

This study of the American engineer from the late 1700's through the 1840's examines the organizational pattern of nineteenth century life by describing the emergence of the civil branch as a recognized specialization in engineering. The author concentrates on those engineers who worked on internal improvements, mainly canals and railroads. He traces the careers of such men as Latrobe, Baldwin, and Brindley, the history of early New York and New Jersey canals, railroads, and such projects, and the development of the national professional association, the American Society of Civil Engineers. (By Daniel Hovey Calhoun. Harvard University Press, Cambridge, Mass., 1960. 295 pp., bound. $5.50.)

Design of Modern Steel Structures

Second Edition

Joints and connections as rivets, welds, bolts, pins and timber connectors and the design of members are treated. Both treatments relate the theoretical concepts to the field of design through specifications, which are referred to by official number. Four important structures are presented as major design examples a building girder, a roof truss designed for both welding and riveting, a low-truss riveted highway bridge and preliminary design of a multi-story office building with welded joints. Major changes in this edition involve the substitution of ultimate-load design for continuous beam design, and emphasis on plastic design considerations. (By Linton E. Grinter. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y., 1960. 491 pp., bound. $9.50.)

Fluid Power Control

Following a review of fluid properties and fluid mechanics, the theory and practice of hydraulic control components, emphasizing control valves, is covered in detail. The discussion in the final section on the recent progress with gaseous working fluids, particularly high-pressure pneumatics, includes systems analysis and design. Overall emphasis is on conversion, transmission, and control of fluid power under conditions for which gravitational effects are negligible. Topics discussed include flow of fluids through closed conduits, orifices and valves, variable-volume chambers, pumps, motors and accumulators. (Edited by John F. Blackburn and others. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1960. 710 pp., bound. $17.50.)

Highway and Airport Engineering

Three quarters of the book deals with the historical development, planning, construction, and utilization of airports and highways, including a brief discussion of Federal-Aid, toll and bond financing, specifications, contracts, geology and soil mechanics, and safety problems. Design problems discussed include location, types of surface, drainage, grades, curves, and the complications of city streets. A section on aerial surveys is included. The final chapters deal briefly with such other fields of cargo moving as waterways, railroads, pipelines, and conveyors. (By Adrian R. Tegault. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1960. 483 pp., bound. $11.65.)

Manual on Industrial Water and Industrial Waste Water

Second Edition

Revision of the introductory section presents a general discussion of the characteristics and potential effects of waste water discharged from the plant, as well as of the characteristics of fresh water for industrial use. The remainder of this volume includes all current ASTM methods for the examination of water. (Published as ASTM Special Technical Publication No. 148-D by the American Society For Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1960. 653 pp., bound. $11.00.)

Der Praktische Stahlbau—Tragerbau

Second Edition

Although published as the first volume of a revised treatise on steel buildings, this work can be used independently. The author provides a detailed treatment of the design and construction of different kinds of beams, columns, and structural frameworks. There is a separate chapter on construction details and one dealing with connecting methods in steel buildings, such as bolts, rivets, and welding. (By Alfred Gregor. VEB Verlag Technik, Berlin, Germany, 1960. 604 pp., bound. DM 44.00.)

Rahmentragwerke und Durchlauftrzger

Sixth Edition

This revised edition of a German treatise on framed structures and continuous beams falls into three main sections. The first, theoretical one, deals comprehensively with the development of the "slope-deflection method," with simple and adequate equations for the different kinds of frameworks. The second section includes over 30 examples of frameworks for bridges and high buildings, showing the practical applications of the text material in part I, and of the extensive, auxiliary tables which comprise the third section. (By Richard Guldan. Springer-Verlag, Vienna, Austria, 1959. 499 pp., bound. $20.00.)

Symposium on Education in Materials

Seven prominent engineers and educators present from their varying points of view the im-

(Continued on page 138)

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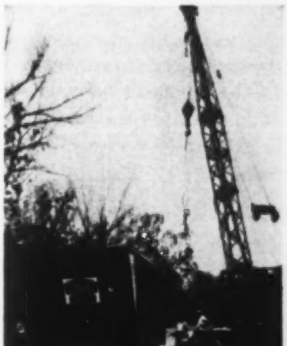

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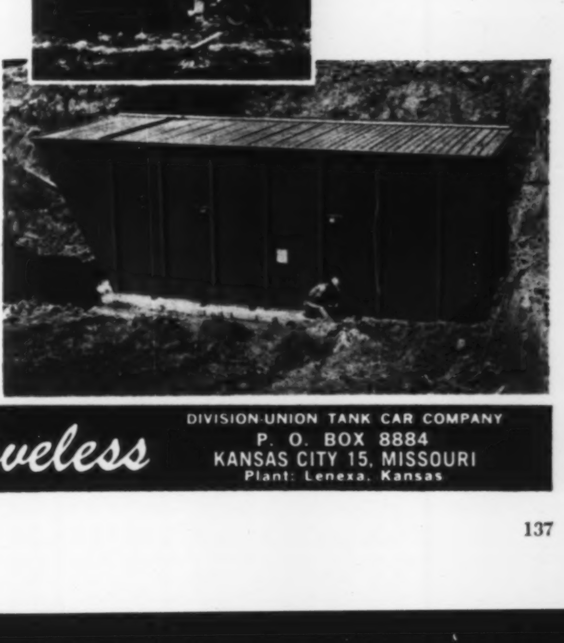

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Recent Books

(Continued from page 137)

pact of engineering materials requirements as related to engineering educators. (Published as Special Technical Publication No. 263, by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1960. 51 pp., paper. $2.00.)

Library Services

Engineering Societies Library books, except bibliographies, handbooks, and other reference publications, may be borrowed by mail by (the Society's initials, eg. ASCE) members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or a microfilm copy of any items in its collection. Address inquiries to R. H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

Statics of Soil Media

Second Edition

This translation of the second edition of Sokolovski's work includes certain revisions and amendments especially provided by the author. The theory of critical equilibrium is discussed in detail in relation to a soil medium, an ideal granular wedge, and an ideal cohesive medium (without internal friction). Applications of the theory are demonstrated in chapters on stability of foundations, slopes, and layered media, and on the pressure of a fill against retaining walls. (By V. V. Sokolovski. Butterworth & Co. (Canada) Ltd., 1367 Danforth Avenue, Toronto 6, Ont., Canada, 1960. 237 pp., bound. $10.50.)

Non-ASCE Meetings

American Institute of Chemical Engineers. National meeting at the Mayo Hotel, Tulsa, Okla., September 25-28.

American Society of Mechanical Engineers-American Institute of Electrical Engineers. Engineering management conference at the Morrison Hotel, Chicago, Ill., September 14-16; and a joint conference on problems of power generation and transmission at the Bellevue-Stratford Hotel, Philadelphia, Pa., September 21-23.

American Welding Society. National fall meeting at the Hotel Penn-Sheraton, Pittsburgh, Pa., September 26-29.

Association of Iron & Steel Engineers. Annual convention at the Public Auditorium, Cleveland, Ohio, September 27-30.

Engineers' Council for Professional Development. Twenty-eighth annual meeting at the Queen Elizabeth Hotel, Montreal, Quebec, October 3 and 4.

Massachusetts Institute of Technology. Host to the Joint Automatic Control Conference on the MIT campus, Cambridge, Mass., September 7-9.

Prestressed Concrete Institute. Sixth annual convention at the Statler-Hilton Hotel, New York, N.Y., September 27-30.

Public Health Service. Water Quality, Measurement and Instrumentation Symposium, sponsored by the Robert A. Taft Sanitary Engineering Center and the Division of Water Supply and Pollution Control at the Hotel Sinton, Cincinnati, Ohio, August 29-31.

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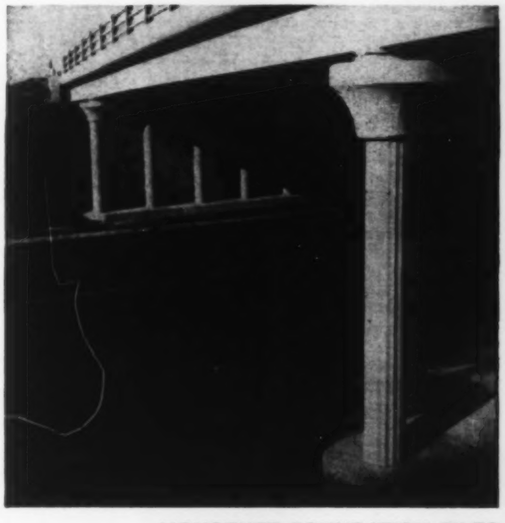

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 60 percent of the first month's salary if a non-member, or 50 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible

The New York office will be open on Thursday evenings until 7:00 o'clock for interviews.

Men Available

Professor of Civil Engineering. F. ASCE, M.C.E., 37. Six years of recent teaching experience—including mechanics, structural and concrete design courses, and graduate courses in theory and design—and 11 years of diversified industrial experience in design and research. Desires permanent teaching position at a university. C-573.

Director of Public Works, F. ASCE, B.S. in C.E. Broad experience in construction, maintenance, utility and transportation operations as chief engineer or general manager of plant account exceeding $100,000,000 and supervising up to 2,300 employees. Location desired, South or West. C-574.

Contract Negotiation and Administration, A.M. ASCE, B.S.C.E. & LL.B. Experience in industrial and government contract negotiation and review, purchasing and tax determination. Location desired, Philadelphia or New York City. C-575.

Construction Engineer, M. ASCE, B.S.C.E.; six years as chief field engineer for Prime-Contractor in the construction of Naval Bases in Spain. C-576.

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Professional work in the development of specifications and estimates for VA hospitals. Positions located in Washington, D. C.

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Professional supervision of the construction of VA hospitals and related facilities. Positions are located throughout the U. S.

B. S. or Professional Degree in engineering and/or professional experience required. Starting salary is dependent upon experience. Liberal leave, life & health insurance plans, good retirement benefits, forty hour week. Address inquiries to

DIRECTOR
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WASHINGTON 25, D. C.

Engineering Trained Businessman, A.M. ASCE. Young executive with graduate studies in both mechanical and civil engineering, has been general manager of a small shipyard for four years. Handled all aspects of business as assistant to president-owner while taking charge of operations. Personable, intelligent and adaptable to any technically orientated industries seeking position as assistant to chief operating executive in any type of manufacturing operations. C-577.

Civil Engineer, A.M. ASCE, B.S.C.E.; M.S.C.E.; M. Engrg. 29, registered P.E. in New York. Several years of supervisory and design experience on soils, foundations, structures, and materials. Seeks opportunity for professional advancement with consultant, architect-engineer, manufacturer or association. Location desired, large eastern city. C-578.

Manager of Construction and Cost Engineering, M.S. in Civil Engineering; 17 years of responsible charge of $78,000,000 in chemicals and metals construction; profitability and cost analysis.

Civil Engineer, M.S.C.E., P.E., M. ASCE. Eight years of supervisory field and office experience in public works, reports, planning and construction on airfield facilities, ports and harbors, flood control and beach erosion. Location desired, New York City or Long Island. C-580.

Civil Engineer or Traffic Engineer, M. ASCE, B.S.C.E., N.Y.S.P.E. 33. Six years of experience in highway planning and design. Desires position in design or research on transportation studies, traffic planning, traffic safety, city planning. Location preferred, New Jersey, New York suburb. C-581.

Engineering Executive, F. ASCE, registered P.E. in five states, including New York. Wide civil and industrial experience, both design and construction. Contract administration, coordination, feasibility studies, resolving of special design problems, excellent at organizing and writing reports. Cleared "top secret". Location desired, New York and New England. C-582.

Structural Steel Fabrications, Design, Estimate or Sales, F. ASCE, B.S.C.E., 52. Thirty years structural steel design and sales, last 16 years exclusively high voltage electrical transmission towers and substations; capable of handling all aspects of transmission line construction including the planning to field erection. Location desired, East or Middle West preferred. C-1103-Chicago.

Structural Engineer, M. ASCE, B.S.C.E., 34. Two years on airfield design and construction, five years on design of hydraulic structures, and four years on supervision of structural design. Location desired, Midwest, West or South. C-1109-Chicago.

Construction Engineer, A.M. ASCE, B.S.C.E., 24. Three years with the State Highway Commission and one year as an estimator for an industrial building contractor. Location desired, Midwest or Overseas. C-1110-Chicago.

Construction Project Manager or Assistant, A.M. ASCE, B.S.C.E., one year graduate work, 28. Seven years of varied experience, with consultant, as teaching assistant, on housing construction, and on road construction with U.S. army Corps of Engineers. Location desired, Foreign. C-1111-Chicago.

Chief Structural Engineer, M. ASCE, B.S.C.E., 35. Nine years of experience in structural design and preparation of drawings for structural steel and reinforced concrete buildings including institutional, commercial and industrial structures of all types. Location desired, West or Midwest. C-1129-Chicago.

Civil Engineer, A.M. ASCE, B.S.C.E., registered P.E., 32. Eight years of heavy construction experience on shafts and tunnels, coffer-dam, bridge, substructures and concrete dams. Location desired, Midwest, South, or West. C-1130-Chicago.

Civil Engineering, A.M. ASCE, B.A., B.S.C.E., 25. Six months in soil (testing), 15 months in structures (R.C. industrial building) and 12 months in highway. Here on student visa. C-1131-Chicago.

Structural Design and Construction Engineer. Student member ASCE, B.S.C.E., will receive M.S. shortly (only oral test incomplete). 21. Design, construction of elevated R.C. reservoir. Design and layout of water supply schemes. Both for one year. Here on student visa. C-1132-Chicago.

Design and Construction Engineer, M. ASCE, CE, License CE California '37. Five years' experience designing, planning, supervising construction of new installations and plant sites for aircraft company; fourteen years' experience in charge of survey, engineering office, calculation of quantity, estimate, design of sewer plants, water treatment plants, subdivision, buildings, streets and highways for contractor, municipal engineers and government. Salary, $9300 a year. Location desired, California. Se-350.

Plan, Design, Construction, F. ASCE, CE, License CE, 55. Twenty-six years of experience on the plan, design, construction, maintenance and operation of highways and bridges; six years as consultant for university; and two years developing housing program for government. Salary, $12,000 a year. Location desired, D.C. Los Angeles, Texas. Se-314.

Design and Construction Engineer, M. ASCE, CE, License CE, Kansas, 38. Twenty-three years of experience in charge of design, construction, traffic studies, drainage studies of highways, bridges, sewer projects, water and sewage treatment plants, for consultants and government. Salary, $9,000 a year. Location desired, West. Se-270.

City Engineer, A.M. ASCE, CE, EIT, Washington, 26. Two years of experience on site analysis, preliminary structure studies, design, cost estimate, draft, specifications on bridges, structures, public works; two years' tests on asphalt, concrete, steel, soils and wood, inspect and design river dam project. Military completed. Salary, $7,200 a year. Location desired, San Francisco, West Coast. Se-876.

Project Engineer, M. ASCE, BSCE and MS Hyd. Engr. 39. Fifteen years broad civil and mechanical engineering experience. Three years in chemical process industries. Experience layout, design and supervision of drawings and specifications for industrial projects, including administration and construction responsibilities. Salary, $10,000 a year. Location desired, Gulf Coast, Southwest, West. Se-792.

Architectural and Structural Design Engineer, M. ASCE, CE, 30. Eight years of experience on design, construction, contract administration including buildings, paving, irrigation facilities and underground tanks. Some water front experience. Salary, $8,100-8,400 a year. Location desired, San Francisco Bay Area. Se-699.

Project Engineer, Manager, M. ASCE, CE Registered Calif., 42. Seventeen years of experience in charge of legal instruments for transfer of real property, maps, design, construction, on highway, bridge construction. Salary, $15,000 a year. Location desired, California, Alaska. Se-169.

Construction Manager, M. ASCE, CE, 48. Twelve years on reports and design; fourteen years as construction office engineer to superintendent. Experience in coordinating construction, various types contracts and subcontracts. Salary, $9,600 a year. Location desired, Southeastern or Central California. Se-1864.

Civil Engineer, A.M. ASCE, CE, 29. Experience in preliminary studies necessary to determine size and location of sewage pumping plants, design of specific plant and its appurtenances for a municipality. Wants experience as estimator. Salary, $6,600 a year. Location desired, New York City. Se-568.

Positions Available

CONCRETE ENGINEER, with several years experience in concrete and concreting materials, with some experience desirable in the precast concrete industry. Location, New Jersey. W-9232.

ENGINEERS. (*a*) Construction Superintendents, BSME or BSCE, with a minimum of 15 years of experience in chemical plant construction, and some experience in contracting. (*b*) Construction Supervisors, BSCE, BSME or BSEE, at project engineer level except in field construction with a minimum of ten years experience in the construction specialty on erection, installation and construction of chemical plants. Location, New York Metropolitan area. W-9224.

ASSISTANT OR ASSOCIATE PROFESSOR, C.E., to teach courses in reinforced concrete, prestressed concrete and soil mechanics. Salary, $5,400-$7,200 for nine months, depending upon qualifications. Location, Midwest. W-9217.

CONSTRUCTION SUPERINTENDENT, experienced in heavy power plant work, civil, mechanical, electrical for 66,000 KW power plant. Salary, $12,000-$15,000 a year. Location, Far East. F-9212.

CITY ENGINEER for large southern city. Good working conditions. Salary, $10,000 a year. Apply by letter giving complete resume of education and experience. W-9210.

COST ENGINEER, 30-40, graduate civil, with experience in keeping complete costs from initial to final construction on heavy construction work, i.e. roads, harbors, bases, foundations, etc. Mostly foreign work and preferably single status. Field engineer who has kept costs will be considered. Salary, $10,000-$12,000 a year, plus living and food. Location, mostly Far East. F-9207.

DISTRICT ENGINEER, graduate civil or architectural, 30-45, preferably with P.E. license and with experience in one or more of the following: Design and construction in structural steel either in a consulting engineers office, a structural steel fabricator, or in the teaching profession; sales promotion; design and construction in reinforced concrete and other structural materials. Some public speaking experience desired. Company will negotiate placement fee and relocation expenses. Prefer applicants who are located in, and familiar with the New England area. Some travel. Location, Massachusetts. W-9177.

CIVIL ENGINEERS. (*a*) Project Engineer, graduate civil, with at least ten years street, highway and general municipal engineering experience. Salary, $9,000 a year. (*b*) Design Draftsman, with experience on streets and highways. Salary, $5,200-$7,800 a year. Location, Connecticut. W-9128.

CIVIL ENGINEERS. (*a*) Resident Engineer, construction, degree in civil engineering or building construction preferred but will consider graduate mechanical or electrical with construction of building structure experience. Minimum of six years in engineering and construction required, including at least three years in field supervising construction of manufacturing plants, office structures, lab. buildings, etc. Will be responsible for supervision of contractors work in construction of sizeable projects in million dollar range or above. Salary, to $10,000 a year depending on experience. (*b*) Associate Resident Engineer, as above, but with about two years of experience. Will supervise smaller projects. Salary, to $8,000 a year. Location, West Coast. W-9122.

CIVIL ENGINEER, about 35, with a background in some municipal work, the planning and layout of developments, drainage design and ability to meet clients and supervise field survey parties and draftsmen. Salary, about $7,500 a year to start. Location, southern New Jersey. W-9119(A).

CIVIL ENGINEER, 25-45, civil or sanitary engineering degree, with experience or interest in heavy processing equipment, such as thickeners, clarifiers, filters and classifiers, to work in sewage and trade waste department serving the sales organization. Service, sales, engineering and test work involved in varying degrees. Salary, $6,000-$9,000 a year; liberal profit sharing plan; and additional fringe benefits. Location, southeastern Pennsylvania. W-9093.

CIVIL ENGINEERS. (*a*) Assistant Town Engineer, civil engineering graduate, New Jersey P.E. license, with municipal construction experience. Salary, $8,000-$9,000 a year. (*b*) Junior Engineer, with civil engineering training or some construction experience. Salary, $5,500-$6,000 a year. Location, northern New Jersey. W-9067.

CITY ENGINEER, graduate C.E., with several years experience in all phases of municipal work and capable of handling engineering matters of a growing city of 13,000 including supervision of Public Works Department, building inspections and city planning. Location, Minnesota. C-8156.

CONCRETE TECHNOLOGY ENGINEER, graduate C.E., 30-40; experience required in theoretical and practical engineering with conventional and lightweight mix designs and construction practices. Experience in field inspection and quality control of concrete is desired. Work includes technical writing, consultation and lecturing before professional groups. Opportunity to participate in development and dissemination of engineering data in the field of quality control as applied to structures. Employer will negotiate placement fee. Location, Chicago. C-8188.

OUTSIDE SALES ENGINEER, prefer CE or ME or equivalent experience. Should be familiar with pumps and application and must be sales minded and have minimum of five years experience in outside sales. Salary, $600-$700 a month. Location, Sacramento. Sj-5386.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

INSIDE OFFICE ENGINEER, CE or ME, age open. Some engineering knowledge and office management experience; interest in doing detail work. To do pump application work, postorder handling and general office management. Salary, $600-$700 a month. Location, San Peninsula. Aj-5385.

DESIGNER, U. S. citizen, single, degree or equivalent, to 45 with good recent expereience in designing, detailing, layout and drafting dock and harbor structures for consulting designing engineer. Will work with structural engineer and port and harbor engineer in developing consulting design engineering type plans in the field. Salary, $1,000 a month plus per diem. About 2 years. Location, Southwest Pacific in Far East. Sj-5379.

PORT AND HARBOR DESIGN ENGINEER, U. S. citizen, single, CE with structural option, under 55. Well qualified by recent design experience plus extensive experience in port and harbor development type work. Will include initial site examination, area evaluation, preliminary layout for structure and service facilities including sketches, and possibly smoother drawings, plus feasibility study and report for a consulting design engineer. Salary, $1,250 per month and per diem. About two years. Location, Southwest Pacific in Far East. Sj-5376.

DESIGNERS, some to extensive experience in preparing structural plans and details for a building and factory for the structural division of a large engineering builder. Salary, $400-$700 a month. Location, San Francisco. Sj-5374.

DESIGNER, at least three years of experience in fields closely related to sanitary engineering, preferably with some experience in consulting engineer's office. Position would develop into key man in organization. Salary, $600-$900, depending on experience. Location, Sacramento. Sj-5366-R.

FIELD AND OFFICE ENGINEER, CE, ME or other degree, under 30. Prefer minimum of two years of work experience with military training completed. Some familiarity with construction plans, specifications and building methods. Train for ten weeks in Eastern headquarters, return to inspection work related to fire insurance for a district office. Some Northern California travel. Headquarters, San Francisco. Car required. Salary about $6,000 a year. Sj-5358.

JUNIOR CIVIL ENGINEER, recent graduate with one to two years of experience for design, office work (irrigation, water treatment) under registered engineer. Salary, $6,000 a year or more depending on experience. Location, San Joaquin Valley. Sj-5355.

STRUCTURAL ENGINEER, graduate CE, 30-50, experience related to structural steel, reinforced concrete and some mechanical design activities. Location, Southern California. Sj-5350.

FIELD ENGINEER, CE, young, one to two years working experience with general contractors on industrial type construction and who might later fit into the construction department of a manufacturing concern. Should be able to assist in representing owners in dealing with construction problems relating to the building of a cement plant (keep progress records, have some knowledge of time and material controls) and be able to relate construction changes to plans and specifications. Salary, about $6,000 a year. Location, Northern California. Sj-5328.

Annual Convention of ASCE

Oct. 10-14, 1960

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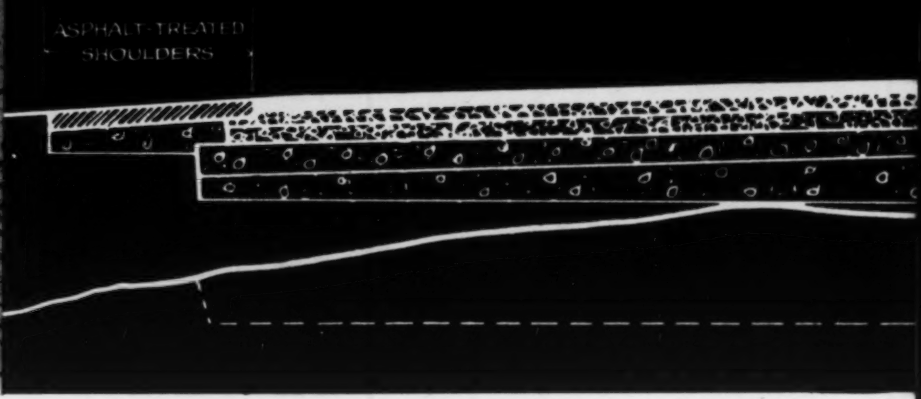
Watertown
Adams

Map shows location of Interstate #81 in Watertown area.



Cross-section diagram shows composition of single 24-foot roadway on four-lane Interstate & Defense Highway #81. Note Asphalt-treated shoulders.

Look what they're doing with DEEP STRENGTH Asphalt Pavement in Upstate New York!

Advanced Asphalt Pavement design, over prepared subbase, solves problems in area where frost depth goes to 48 inches

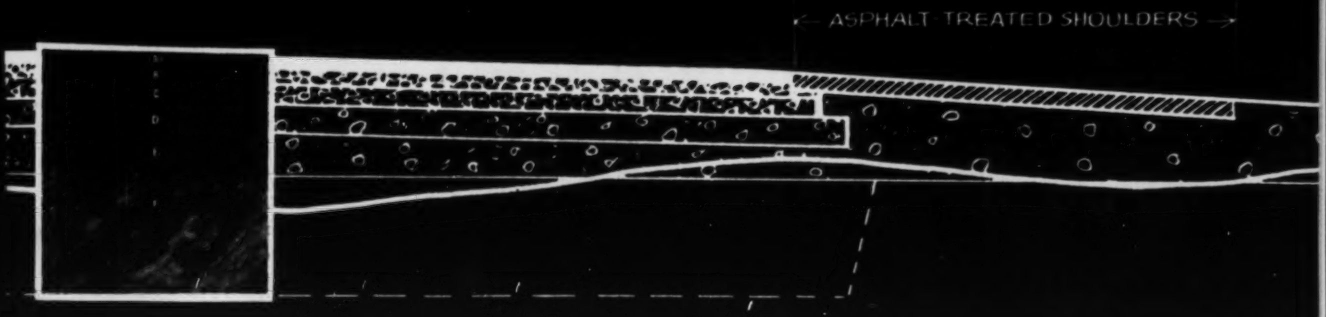
Boulder-strewn glacial till near Watertown presented New York State Highway Department engineers with unusual problems. Here, winter temperatures often reach 20° to 25° *below* zero. The frost depth extends to 48 inches. In cuts, severe frost action sometimes forces boulders *through* the pavement with subsequent break-up and failure.

The cross-section and diagram on this page show how DEEP STRENGTH Asphalt pavement design solved the problems. Notice how the precepts of new DEEP STRENGTH Asphalt design are carried out. They include Asphalt base, Asphalt-treated shoulders, depressed median for good drainage and flat slope embankments for better safety. Capillary moisture action and frost damage are prevented by building the road structure with selected materials.

When designed like this—for DEEP STRENGTH—Asphalt pavements will carry the heaviest traffic loads without distress . . . with minimum maintenance cost. For example, the DEEP STRENGTH Asphalt-paved New Jersey Turnpike carried over 46 *million* vehicles during 1959.

In cuts, engineers excavated below frost level and prepared subbase using suitable locally available materials.

A 2½-inch Asphalt top course is applied over 3-inch plant-mixed Asphalt base and a 4-inch broken stone bottom course.



SAVE MONEY, TOO! Modern low-maintenance DEEP STRENGTH Asphalt pavements often cost *less* to build than Asphalt pavements designed to other standards. That's because the Advanced Design Criteria often permit Asphalt base to be substituted for some of the more expensive Asphalt concrete surfacing, and allow reduction in total structure thickness when used in place of untreated base.

NEW HANDBOOK . . . a new edition of the *Asphalt Handbook* incorporating all the Advanced Design Criteria implied by the term DEEP STRENGTH Asphalt Construction soon will be available at the Asphalt Institute office serving your area.

ASPHALT HANDBOOK

THE ASPHALT INSTITUTE
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THIS IS DEEP STRENGTH

A
2½-inch Asphalt concrete surface course

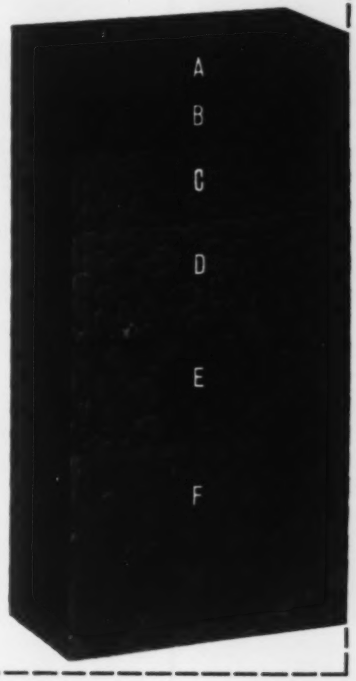
B
3-inch Asphalt base course

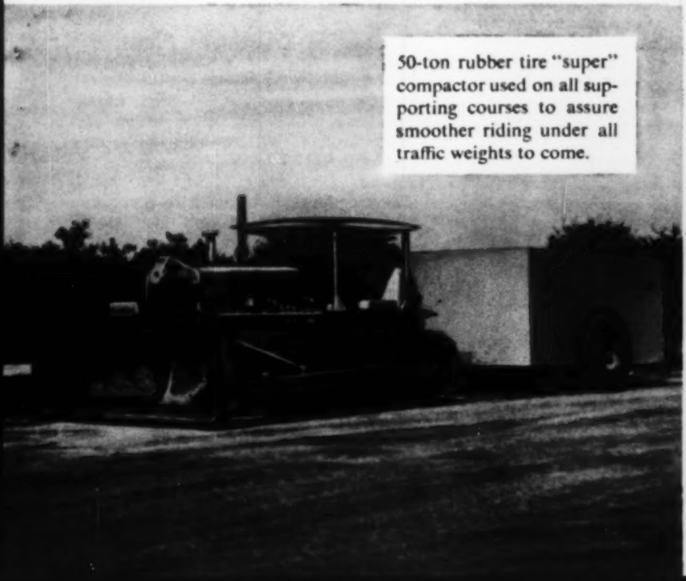
C
4-inch base course of broken stone

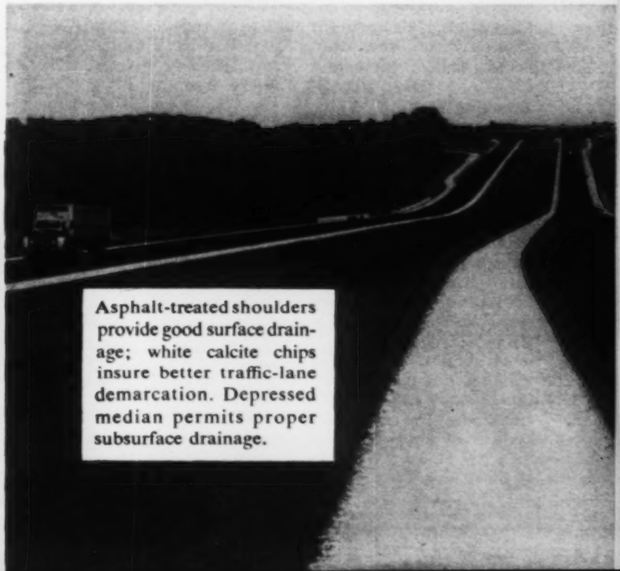
D
6-inch graded gravel subbase

E
6-inch bank-run gravel foundation course

F
Excavated to 48 inches below pavement grade in cuts—locally available backfill material compacted with "super" compactor.




50-ton rubber tire "super" compactor used on all supporting courses to assure smoother riding under all traffic weights to come.


Asphalt-treated shoulders provide good surface drainage; white calcite chips insure better traffic-lane demarcation. Depressed median permits proper subsurface drainage.

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Reusable Batter Washer

THE REUSABLE BATTER WASHER is a new addition to the company's continually expanding line of form ties, anchors, inserts and accessories developed for the concrete construction industry.

The Batter Washer has been designed to, whenever practicable, hold a Tylag at an angle up to 45 degrees without need for expensive wedging, thereby eliminating the material and labor costs involved in wedging and making the job of installing and stripping form's faster and easier. This is made possible by a slot in the haunch at the top of the Batter Washer which allows the Tylag to swing freely to the desired angle. Nail holes are provided for easy, accurate attaching to wales or strongbacks and multiple lumber grips on the underside prevent slippage when the Batter Washer is not nailed. **Richmond Screw Anchor Co., Inc., CE-8, 816-838 Liberty Ave., Brooklyn 8, N. Y.**

1/2
RICHMOND

New, Reusable

Carbide Bits

NEW TUNGSTEN CARBIDE INSERT bits for maximum efficiency with the Mole-Dril have been introduced. The new combination drills larger diameter holes, to achieve optimum results with inexpensive blasting agents. Drilling costs are trimmed regardless of the hardest and most abrasive formations encountered.

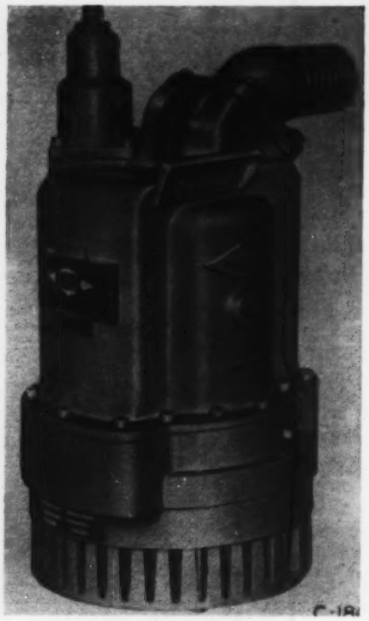
Using premium grade carbide inserts, the bits are engineered to exacting specifications for maximum service. The body is of top quality forged steel alloy. Precise and rigid manufacturing controls the brazing of the insert into the body. Drill disassembly is eliminated. Reversed buttress threads assure trouble free attachment of the bit to the Mole-Dril. **Gardner-Denver Co., CE-8, Quincy, Ill.**

Submersible Contractor's Pump

ALWAYS PRIMED, THE TYPE SA submersible contractor's pump is designed to simplify dewatering problems; suction hose is eliminated.

To operate, just lower it into the water, plug in the cables, attach the discharge hose, and turn the start knob. It will pump whatever water comes in, even if it is only 5% of the pump's capacity. It operates in muddy water or sludge, under flood or semi-dry conditions, in hot or freezing climate.

Water discharge passes along the side of the motor, cooling the specially insulated windings. Motor ball bearings are lifetime lubricated. Pressurized double seal runs in oil, protecting it from grit and abrasion.



Simplifies Dewatering Problems

The rubber-lined pump case and a special tough alloy impeller are resistant to wear of abrasive sand and mud. Light weight alloy casing resists action of salt water, and erosive or contaminated water. **Pacific Pumping Co., CE-8, P.O. Box 44, Oakland, Calif.**

Electric Rammer

A NEW ELECTRIC RAMMER, the Model EVR a twin brother to the world famous GVR 100-C gasoline rammer, has been announced. The EVR 120 operates on 3-phase, 60-cycle, 220 volts. A flick of a switch instantly delivers a constant rate of 600 blows per minute, 350 ft lb per second yet weighs only 112 lb. The electric motor is a squirrel cage motor and has no brushes or commutators eliminating practically any maintenance.

Model EVR

The equipment is for compacting areas within enclosures where gas fumes or ignition spark is prohibited such as in buildings, near oil refineries, missile bases, etc. It is also ideal for compacting in deep trenches for water, sewer or gas trenches. **Wacker Corporation, CE-8, Hartford, Wis.**

Sewage Treatment Plant

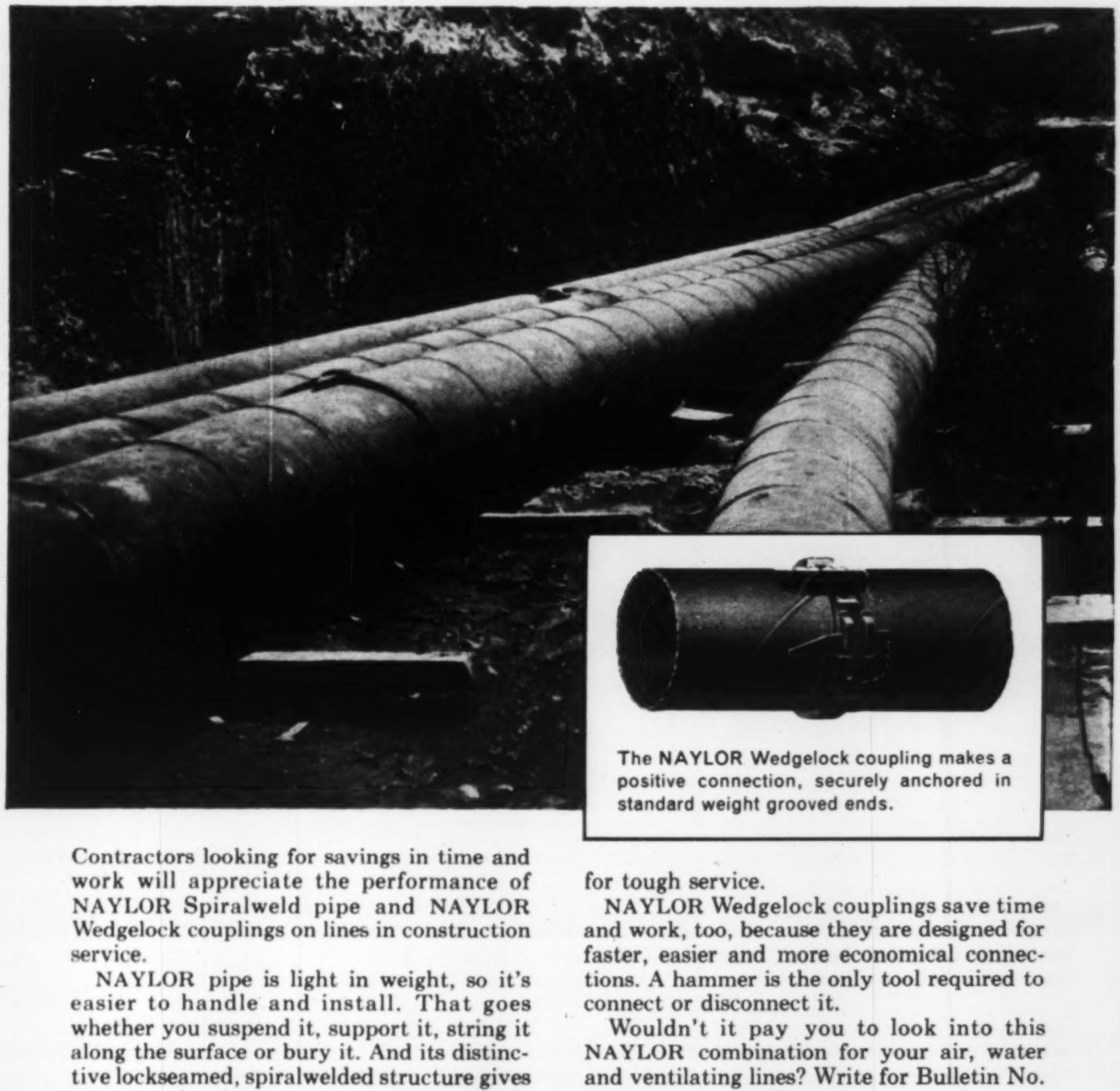
A NEW, LOW COST sewage treatment plant to serve small subdivision, industrial plants, motels, shopping centers and similar projects with population groups ranging from 75 to 3000, has been announced.

Identified as the Accelo-Biox plant, one type of this package unit for sewage treatment by the "total oxidation" method uses atmospheric oxygen to sustain the organisms which purify the sewage. A Vortair aerator entrains vast quantities of air and mixes, recirculates sludge and clarifies within a single tank.

Because this plant operates without air compressors, there is virtually no noise—a great advantage in motels, trailer courts, etc.—and less power is required. **Infilco Inc., CE-8, Tucson, Ariz.**

PIPE LINE COMBINATION

For Contractors on the Move!



The NAYLOR Wedgelock coupling makes a positive connection, securely anchored in standard weight grooved ends.

Contractors looking for savings in time and work will appreciate the performance of NAYLOR Spiralweld pipe and NAYLOR Wedgelock couplings on lines in construction service.

NAYLOR pipe is light in weight, so it's easier to handle and install. That goes whether you suspend it, support it, string it along the surface or bury it. And its distinctive lockseamed, spiralwelded structure gives you pipe that is extra strong and extra safe for tough service.

NAYLOR Wedgelock couplings save time and work, too, because they are designed for faster, easier and more economical connections. A hammer is the only tool required to connect or disconnect it.

Wouldn't it pay you to look into this NAYLOR combination for your air, water and ventilating lines? Write for Bulletin No. 59 to get the details.

NAYLOR PIPE *Company*

1281 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

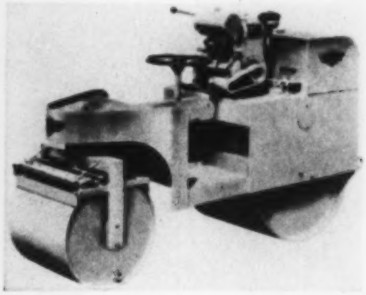
New Engine

A NEW ENGINE WHICH RUNS on high or low test gasoline, diesel oil, kerosene, fuels or even cleaning fluids are being introduced to the United States. It is suitable for use in cars, trucks, buses, tractors, farm machinery, boats, many industrial applications such as electronic power generation, and for contractors' equipment.

Main significance of the new engine is that it will allow utilization of the most economical kind of fuel available in any given area. It also means that if one kind of fuel is not available, another can always be used. There is, so to speak, no danger of running out of gas—all one would have to do would be to fill it up with diesel oil or kerosene. **Rootes Motors, Inc., CE-8, 42-32 21st St., Long Island City, N. Y.**

Tandem Roller

THE DEVELOPMENT OF A NEW 1½ to 2 ton tandem roller has been announced. The Model 220 has been designed to cut compaction costs and at the same time offer service-free performance with no greasing required. In line with the company's program of advanced design and development, this roller offers the additional safety factors of greater over-all visibility and longer life with an automotive type brake located on the compression roll. Larger, wider rolls and a lower center of gravity give this roller considerably more stability.



Model 220

Less maintenance is assured with the constant-mesh transmission, with readily accessible clutches, heavy duty roller chain and sprockets on the final drive, plus lifetime lubricated bearing.

Operators will find that the automotive type steering makes this roller one of the most comfortable and convenient to operate, according to the manufacturer. Essick larger diameter guide rolls stay on top of the asphalt, resulting in better densities and smoother surface finishes. **Essick Manufacturing Co., CE-8, 1950 Santa Fe Ave., Los Angeles 21, Calif.**

Climbing Crane

FIRST IN THE UNITED STATES to use the Linden Climbing-Crane, which raises itself from floor to floor while work is in progress, is North State Builders, Ltd., Menlo Park, Calif.

Because it stays on top of the job, no matter how high up the building goes, and is operated by one man from the working deck where he can see everything, the problems of street access and unnecessary ramps and runways can be forgotten. The Climbing-Crane pours concrete and hoists other materials, landing them quickly, exactly where needed.

The one man who remote-controls its work with a 3½-lb electronic panel can

(Continued on page 148)

The "3-Ms" in M&H Products

There are 3 Ms in M & H production operations which explains to some extent the wide popularity and increasing sales of M & H valves, hydrants and accessories. The 3 Ms are Men, Machines and Materials. They are the foundation of the superior design, rugged strength and high quality which users of M & H valves and hydrants have so widely recognized.

It requires all three in combination to produce a product which meets M & H standards. M & H foundry raw materials (pig iron, molding sand, everything) and the finished castings (cast iron or bronze) meet latest engineering standards. M & H foundry and machine shop both have efficient, modern equipment. Far more important than either of the foregoing, M & H workmen are craftsmen—skilled in their respective jobs, proud of their work, loyal to their Company and as much interested in making a good valve as is the boss in the office!

So, an M & H customer gets more than just a valve. He gets quality control of materials. He gets improved fabrication by modern machinery. He gets the skillful work of craftsmen who are proud of their job.

These are the 3 Ms which have placed M & H products in the forefront of the American valve and hydrant industry.

(No. 3 of a Series)

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

Laying second course of plant-mix Texaco Asphaltic Concrete pavement on highway through Ocala National Forest.

View of right of way cut through virgin forest for new highway. Limerock foundation at left is ready for Texaco Asphalt pavement.

Contractor: MARION CONSTRUCTION COMPANY, Ocala, Florida

Builds ASPHALT highway through virgin forest

The Florida State Road Department has constructed 13 miles of Asphalt-paved highway through the Ocala National Forest, in the state's northeastern corner. All but half a mile of this highway is located on new right of way, cut through virgin forest and swamp.

Plant-mixed Texaco Asphaltic Concrete, laid in two courses with a combined thickness of three inches, gives this highway a highly durable and resilient surface. Supporting it is an 8½ inch foundation of limerock. A Texaco Asphaltic Concrete pavement like this one withstands hard usage year after year with a minimum of maintenance. It is speedily laid and ready for traffic, because it requires no time consuming curing period, Motorists prefer the velvet smooth riding quality of its resilient, joint-free surface. Thanks to its skid-resistant texture and the sharp visibility of traffic lines on its dark surface Texaco Asphaltic Concrete greatly reduces the danger of accidents.

Whether your highway or street project calls for heavy-duty, intermediate or low-cost paving, there is a type of Texaco Asphalt construction exactly suited to your requirements, If you would like assistance with a paving problem, our 55 years of Asphalt experience is at your service. Ask our nearest office to have one of our field representatives contact you.

Division Offices: TEXACO INC., Asphalt Sales Div., 135 E. 42nd Street, New York 17 • Chestnut Hill 67, Mass. • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 1 • Minneapolis 3 • Philadelphia 2 • Richmond 25

TEXACO

TEXACO ASPHALT

Please send me your two brochures containing helpful information on heavy-duty, intermediate and low-cost types of asphalt construction for highways, streets, airports, etc.

Texaco Inc., Asphalt Sales, 135 E. 42nd St., **New York 17, N. Y.**

Name.. **Position**...............

Associated with...

Address ....

slew, hoist and luff at the same time. He is free to move to any part of the job, and to assist with loading and unloading.

The tower protrudes far enough above the elevator or stair shaft in which it climbs to provide clearance for the construction of two floors. When these are completed, the crane climbs up by its own hoisting winch to work on the next two floors. When the building is completed, the crane comes down quickly and easily as no part weighs more than one ton. **B. M. Heede, Inc., CE-8, 30-01 37th Ave., Long Island City 1, N. Y.**

Pitcher Sampler

An unique tool, the Pitcher Sampler is designed specifically to recover accurate samples from formations that are too hard for thin-wall shelby samplers or too brittle, soft or water-sensitive to permit satisfactory recovery by conventional core barrel type samplers. Two years of successful application in virtually every type of "problem" formation prove that the Pitcher Sampler saves time and money and insures exceptional accuracy, according to the manufacturer.

Some of the tool's many features include: heavy-duty, triple ball-bearing hanger is sealed 4-ways against drilling fluid to prevent freeze-ups and insure long, trouble-free service; no more crumpled shelby tubes, no presetting and no surface control needed; sliding valve directs drilling fluid through shelby tube to hole bottom for thorough flushing action, then automatically diverts fluid from tube when tube contacts bottom; drilling fluid cannot undercut shelby tube and erode or contaminate sample even of softest materials; samples all materials including soft rock from top to bottom of hole; and the drill can be stopped, rod rechucked (even raised slightly) without breaking core. **Mobile Drilling Inc., CE-8, 960 N. Pennsylvania St., Indianapolis, Ind.**

Front-End Loader Transmission

A new heavy-duty version of the company's present front-end loader transmission has been announced.

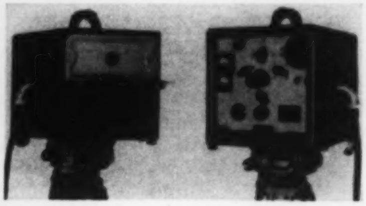
Designated the CRT-3531, the unit is designed to handle 350 net ft lb of engine torque, while at the same time permitting increased hydraulic horsepower for bucket operation.

A special new three-element torque converter has been developed that will provide high torque multiplication coupled with high efficiency for the most profitable operation. The torque converter has a stall ratio of 3.7:1 which, coupled with the low range of the transmission, provides an overall engine torque multiplication of 29.6.

Job-proven transmission ratios for loader operation have been retained as a result of extensive field studies. These ratios are 8:1 in low, 2.9:1 in intermediate and 1:1 in high. The transfer gear ratio offered in this new transmission is .659:1. **The Allison Division of General Motors Corp., CE-8, Main & Speedway, Indianapolis, Ind.**

Improved Surveying Instrument

A new device offers users a number of important advantages over previous models. Some of the advantages of the Geodimeter Model 4B include: a reading dial numbered to every ten divisions and, thereby improving readability. A new null meter and control instrument enables faster observations; a course site included within the instrument and, therefore, a reduction of at least 25% in pointing time; a Kerr cell heater installed in the instrument, permitting operation in a range of temperatures from minus 40F to plus 120F; weight reduction of 20%; the instrument weighs less than 30 lb; and longer operating range in bright sunlight; up to 5,000 ft. **Geodimeter Co., AGA Corporation of America, CE-8, 2013 Park Ave., S. Plainfield, N. J.**



Model 4B

Nacor Anchor Bolt Cement

An improved pourable cement, reputed to greatly reduce time required for securely setting anchor bolts, has been announced. Offered under the tradename "Nacor Anchor Bolt Cement," it is fur-

(Continued on page 149)

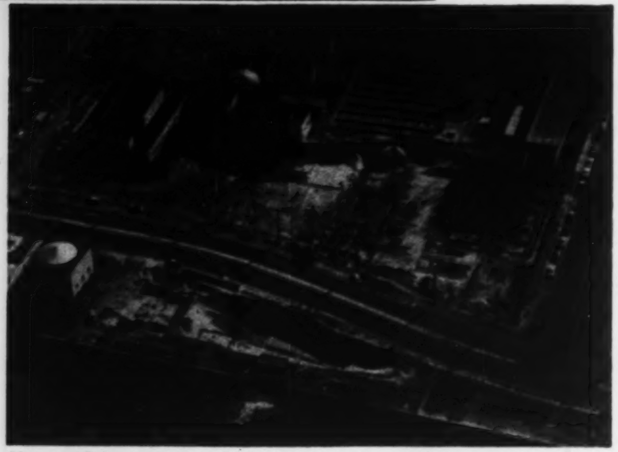
How to handle WET JOBS

1950 Project: Sewage Plant, Rockaway, N.Y.

Contractor: Merritt-Chapman & Scott Corp.

1960 Project: Plant addition.

Contractor: D. Fortunato, Incorporated.



Unusual features marked 2 predrainage operations at this site. In 1950, an unbraced cofferdam was maintained 30′ below bay. In 1960, wellpoints were tunneled under structures as plant kept working. Both jobs successful – both by Griffin.

GRIFFIN WELLPOINT CORP.

SALES • RENTAL • CONTRACT

881 East 141st St., New York 54, N. Y.
Hammond • Houston • Jacksonville • West Palm Beach

25th YEAR

In Canada: Construction Equipment Co., Ltd. • In Venezuela: Drew Bear & Sons C. A.

EQUIPMENT MATERIALS and METHODS

(continued)

nished in powder form. Mixed with water, it becomes semi-fluid, easy to pour or trowel.

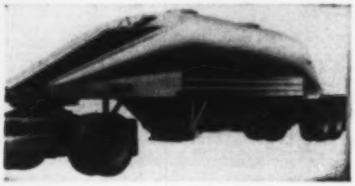
Applied around a bolt, it bonds itself firmly to both bolt and hole surfaces. It is claimed to set in 10 minutes with virtually no shrinkage. The manufacturer states that anchor bolts in Nacor cement can be drawn tight and ordinary stationary equipment put in operation within 30 minutes. A 60-min waiting period is recommended for extra heavy vibrating machinery; the material is oil resistant.

Nacor Anchor Bolt Cement is recommended for fastening of partitions, pipe flanges, hand rails, seats, toilets, parking stanchions, guide posts and fences. **National Asphalt Corp., CE-8, Brooklyn Station, Cleveland 9, Ohio.**

Enclosed Hopper Trailer

NEW ENCLOSED "MONO-SHELL" Hopper Trailers are used in the hauling of bulk materials such as cement, sugar, grain and other products which must be protected from the elements.

The exclusive "Mono-Shell" design makes possible, according to the manufacturer, the largest legal payload of any hauling method. The contours of the body itself constitute all the required strength and support, eliminating truss frames, body longitudinals and cross braces.



"Mono-Shell" Design

Patented "Butterfly" Gates seal the load completely from dirt and water, yet allow for fast, safe dumping. Solid or Split Butterfly Gates are available. With the Split-Butterfly gate the contractor can haul both powdered or granular materials and aggregates up to 1½ in. diameter. A removable sock assembly is easily attached to protect the load during discharge. The units may be compartmentalized, each with its own discharge gate, for hauling two or more different commodities at once. Loading hatches have vented self-locking covers which allow free "breathing" yet keep water out. **Gar Wood Industries, Inc., Customer Service Dept., CE-8, Wayne, Mich.**

Architects and Engineers: Reynolds, Smith and Hills,
Jacksonville, Florida

Vibroflotation®

was used to compact the sandy soil at Jacksonville television station.

Vibroflot machine in action. Each compaction consumed 3 or 4 tons of sand.

The foundation for the new WJXT building in Jacksonville, Florida, was built on sand compacted by Vibroflotation at a savings estimated at about $8,500 over the use of piling.

774 compactions were made to an average depth of 11 feet to obtain a minimum 70% relative density over the entire building area.

Proven applications of foundations upon sand total over 100+ contracts throughout the U. S. A. and Canada.

Write for Booklet C-25

Proven Applications

Deep Foundations • Dams
Bridges • Airports • Tunnels
Commercial Foundations
Industrial Foundations

VIBROFLOTATION FOUNDATION CO.
930 Fort Duquesne Boulevard
Pittsburgh 22, Pa.
ATlantic 1-2500

Portable Pump Rig

A UNIQUE PORTABLE PUMP RIG which speeds up hydrostatic testing of valves and other equipment has been built. The unit is used throughout the refinery, wherever water and air connections are available.

The portable hydrostatic test unit consists of a horizontal air-operated hydropneumatic pump with a rate capacity of 7,330 psi, which is mounted on a rubber-tired cart. It supplies hydrostatic pressures ranging from 250 lb to 2500 lb. Operated by plant air at 90 psi, it works quietly without vibration.

The portable pump is used mainly at "turn-around" time when refinery units are dismantled, inspected, and restored to optimum working order. Many valves are inspected, rebuilt if necessary, and then tested for leaks under hydrostatic pressure. Relief valves, in addition, are hydrostatically tested for correct operation.

In the valve repair shop, the pump is connected to a test stand on which the valves are mounted. Hydrostatic pressures ranging from 125 to 250 psi are then created, enabling the maintenance staff to spot leaks instantly and also adjust relief valve springs to precision settings for specific design pressures. **Aldrich Pump Co., CE-8, 1 Pine St., Allentown, Pa.**

Power Truck

THE MODEL M-30A POWER TRUCK features a new Borg-Warner torque converter drive, easy steering and braking, lower center of gravity and convenient operator controlled dumping action. The three element, single stage torque converter eliminates clutching shifting, and delivers quick acceleration for high production on engineered construction.

The M-30A is powered by a Wisconsin 18 hp air cooled engine driving directly into the converter and transmission; 12-volt electric starting is standard. Operation is simple and safe, with an oil cushion protecting all moving parts and reducing mainenance costs.

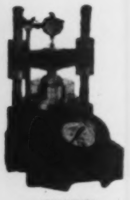
Standard beds for the Prime-Mover include an 18 cu ft dump body and a 42 in. x 42 in. flatbed. The bulk handling bed has a sliding endgate, swinging tailgate and dumping controls to accommodate varied rates of load discharge. **The Prime-Mover Co., CE-8, Muscatine, Iowa.**

Soil Permeability Device

AN IMPROVED MODEL INSTRUMENT for use in soils and aggregate laboratories for fast determinations of permeability and for observation of the quicksand phenomena has been announced.

Called the Plastic Permeameter, the device can be used for tests on sands, gravels, or mixtures of both and for small scale tests on graded filters for dams, filtration plants and drains

The instrument's transparent plastic construction enables the operator to observe the soil and water flow during the test. The permeameter tank has a 2½-in. internal diameter and accommodates a 10-in. high specimen; overall height is 14 in. The device is supplied with all accessories including piezometer tubes and fittings for inlet and outlet of water. **Soiltest, Inc., CE-8, 4711 W. North Ave., Chicago 39, Ill.**

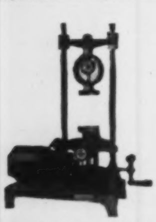


CONBEL
Consolidation Tester
Capacities to 10,000 lbs.

TESTING SOIL SAMPLES?

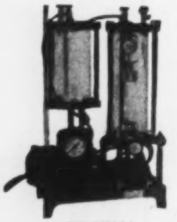
. . . take a closer look at the Tinius Olsen line of K-W Physical Soil Testing Machines. These rugged, portable units are designed for convenient "table top" operation in the lab or on the job site.

Get the full story. Write today for Bulletin 50-A.



UNCONFINED COMPRESSION
Manual or Motor Driven Models

DIRECT SHEAR



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Capacities to 3,000 lbs.

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ASCE Electronic Computation Conference

September 8-9, 1960

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For one per day	$14.00	$18.00 ....
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Twin bedroom with	$15.00	$17.00 ....
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Studio suite	$33.00	$40.00 ....
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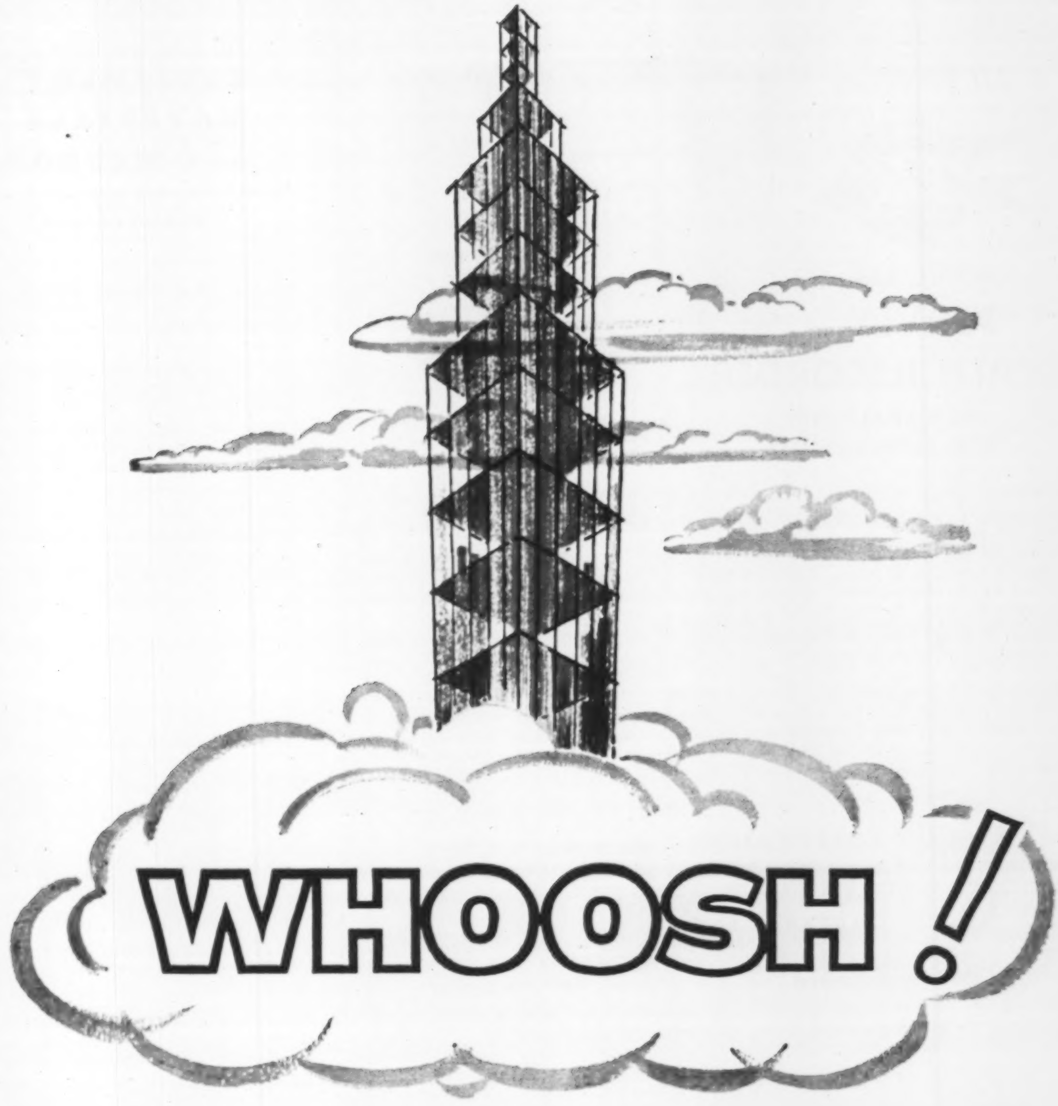
More than two persons in one room, $4.00 each additional person.

Reservations must be received two weeks prior to the opening of convention



Steel goes up fast with high-strength bolts

It takes just seconds to permanently tighten a high-strength bolt. No more than two men are needed to perform this high-speed operation.

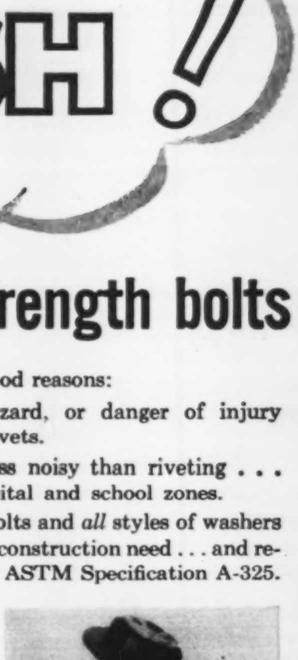
Speedy erection—with bolts—saves money for the erector, the contractor, and the owner. The bolters can follow on the heels of the erectors, eliminating costly delays; the contractor's form-work no longer has to trail two stories behind. And the owner is ahead, too, because he can rent his building days, and often weeks sooner, when it's bolted. That's why architects and engineers specify high-strength bolting.

There are other good reasons:

Safety—no fire hazard, or danger of injury from tossed rivets.

Noise factor—far less noisy than riveting . . . ideal for hospital and school zones.

Full size range—of bolts and *all* styles of washers to meet every construction need . . . and requirements of ASTM Specification A-325.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

NEW from

Edo

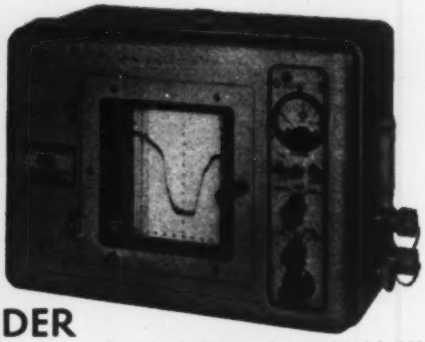
MODEL 555

SURVEY

DEPTH RECORDER

NEW RELIABILITY!

NEW SERVICEABILITY!



Improved design of new Model 555 Survey Depth Recorder means greater accuracy, ready accessibility of all components for maximum servicing ease.

EDO, world leader in hydrography, presents the new Model 555 Survey Depth Recorder, incorporating numerous mechanical and electrical advances in the technique of echo-sounding survey.

Research and development undertaken for the U.S. Navy have resulted in the complete re-design of Edo's pioneering Model 255 Survey Depth Recorder. The new Model 555 is already being delivered in quantity to the Navy for upward-looking scanning by submarines submerged beneath ice, as well as for bottom scanning.

Light in weight (only 55 lbs.), easy to operate and extremely accurate, Model 555 is suited to temporary or permanent installation aboard vessels of every size. The new superheterodyne receiver assures sharp, precise recordings, while Edo's new Model 480 transducer, a barium titanate block type, improves sensitivity and definition 100 per cent.

Model 555 gives permanent readings on over-lapping range scales from 1½ feet to 230 fathoms. The wide transducer beamwidth—20 degrees at minus 10 db points—provides excellent penetration and broad coverage for all types of general underwater survey.

Send for brochure, Dept. V-4.

Edo CORPORATION, College Point, L. I., N. Y.

ADVANCE REGISTRATION

ASCE Conference on Electronic Computation

At the Pittsburgh Hilton, Pittsburgh, Pa., Sept. 7-9, 1960

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Registration fee (Wives free) .... $5.00 ....

Thursday Luncheon .... 4.25 each ....

Friday Luncheon .... 4.25 each ....

Total enclosed $..........

Make checks payable to D. E. Oelschlager, Finance Chairman

Mail to: Chas. A. Keelen, c/o Portland Cement Association, 2431 Koppers Building, Pittsburgh 19, Pa.

PLEASE RETURN BY AUGUST 20, 1960

Registrants will receive tickets to Computer Seminars and to reception.

Please pick up tickets at Conference Registration desk after 3:00 p.m. on September 7, 1960.

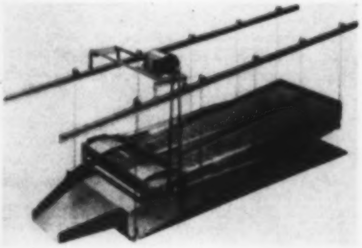
EQUIPMENT MATERIALS and METHODS

(continued)

New Shaker Screen

The trend to compact design with increased operational capacity features a new shaker screen which is used for coal, ores, rubble, crushed stone and other bulk solids.

In obtaining this compactness and greater screen capacity, the company's engineers integrated the drive to eliminate the cumbersome drive arms and provide that extra space for the screen capacity. The drive and screen are suspended from wire rope. When in operation by this arrangement, reciprocating forces are not transferred to the structure.



Increased Operational Capacity

Drive mechanism of the shaker screen is an enclosed self-contained unit with forced lubrication and all anti-friction bearings. Units are furnished with the desired stroke and speed ranging from ½ in. at 1000 rpm to 5 in. at 165 rpm. Speed and stroke can be adjusted and varied. Power is supplied by a 3-phase induction motor. **Fairmont Machinery Co., CE-8, Fairmont, W. Va.**

Intake Ring Gates

Under construction are seven intake ring gates, which, when put into service, will control the flow of the Missouri River to the turbines of a new hydroelectric generating plant. The new gates are part of the Oahe Dam and reservoir near Pierre, South Dakota.

All seven assemblies, including frames and gates, will be cast, or fabricated by welding and machining in the company's Birmingham shops. Each individual frame and gate will be built in sections, assembled and machined within .0625 thousandth of an inch of a perfect circle. Each unit will weigh 238 tons with eight flat cars required for transporting each frame.

(Continued on page 153)

EQUIPMENT MATERIALS and METHODS

(continued)

The gates will be push button, mechanically opened and closed. Water from the Missouri will flow into these gates and drop straight down over a 100 ft and go by tunnel and penstock into the turbines. The power plant will produce about 3 billion kilowatt hours of electrical energy per year. **Goslin-Birmingham Mfg. Co., CE-8, 3523 10th Ave., N. Birmingham, Ala.**

New Digitizer

ENGINEERS, HAVING CREATED automation to take on a steadily-increasing share of the nation's labor, are turning now to automation for their own engineering chores.

Contour mapping, essential for laying out new highway routes, for inventorying stockpiles of coal, sand or other material, and for other purposes, can now be almost completely mechanized.

A digitizer, specially built for the company by AIL Division of Cutler-Hammer, Inc., Mineola, N. Y., not only saves time and man-hours of skilled work, but reduces the need for mapping in some special fields.

The equipment works from aerial photographs, in conjunction with a Wild stereoplotter, recording coordinates from the photos on paper, in light signals and on punched paper tape. It requires one operator, in place of three formerly needed. In addition, the punched tape eliminates further work in preparing data that can be used in a computer to process the results required. Terrain data, processed in this way, is a low-cost substitute for weeks or months of field survey by ground engineering crews. **Lockwood, Kessler & Bartlett, Inc., CE-8, One Aerial Way, Syosset, N. Y.**

Water Storage Tank

A NEW-TYPE WATER STORAGE TANK, the Cylindroid is designed to meet a critical need among growing communities for a low-cost reservoir which can be built to any capacity to serve present and future requirements.

The tank provides approximately 16% more storage capacity than do comparable cylindrical tanks. The Cylindroid also costs less to build, because it makes possible the use of lighter steel; it requires a minimum of shop forming and prefabrication; and it can be erected on the site with a small crew and light equipment. Because of its low height, the Cylindroid can be easily screened with trees and landscaping in residential areas. **Graver Tank & Mfg. Co., CE-8, 4809 Tod Ave., East Chicago, Ind.**

IS YOUR LITERATURE FILE COMPLETE?

YEOMANS BROTHERS COMPANY, 2000-7 N. Ruby St., Melrose Park, Ill.

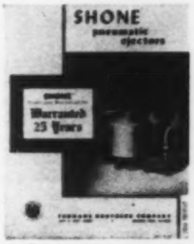
Please send me the literature checked below . . .

☐ No. 6661 ☐ No. 4007 ☐ No. 6250-R ☐ No. 300 ☐ No. 4408
☐ No. 102 ☐ No. 6751 ☐ No. 6770 ☐ No. 6505

Name ……………………
Title ……………………
Company ……………………
Street ……………………
City …………… *Zone* …………… *State* ……………

NEW

The Hi-Cone Surface-Aeration System
HI-CONE ® Surface Aeration Waste Treatment System, No. 6661



SHONE ® Pneumatic Ejectors, Mechanically Controlled, No. 4007

VERTICAL SEWAGE PUMPS, Centrifugal Type, No. 6250-R

SPIRAHOFF ® System. Primary Settling and Sludge Digest., No. 300

EXPELSOR ® Pneumatic Ejectors, No. 4408

NEW

CAVITATOR ® Aerator Waste Treatment System, No. 102

Streamline Sludge Collectors
STREAMLINE Sludge Collectors, Conveyor Type, No. 6751

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ROTARY DISTRIBUTORS
ROTARY DISTRIBUTORS for Trickling Filters, No. 6505

YEOMANS

2000-7 N. Ruby St.,
Melrose Park, Ill

A-6030

Windrow Sizer

A 25-FT WIDE AIRPORT version of the Ko-Cal windrow sizer working at the Marine Corps Auxiliary Air Station, Yuma, Ariz., is one of several types manufactured by the company.

On the Yuma job the windrow sizer is being used to prepare runway base material for cement stabilization treatment by forming it into windrows of predetermined size. As the machine windrows the material, it dumps the excess off to one side so that exactly the right amount of material for mixing with the cement remains inside the forms.

The windrow sizer is pulled by two crawler tractors and rides on the forms; but like other Ko-Cal windrow sizers, it is fitted with both flanged and rubber-tired wheels so that it can operate either on forms or on an adjoining concrete slab.

Powered hydraulic cylinders raise the machine to sufficient height to cross bridges. Final grade is set with an adjusting screw, and the relative depth of scarifier teeth to blades is adjustable to compensate for local conditions or wear. The conveyor is reversible at will to deposit waste at either side of the machine. **Koehring California Co., CE-8, P.O. Box 1891, Stockton, Calif.**

New Conveyor Design Utilizes Prestressed Concrete

A MATERIALS HANDLING SYSTEM that uses prestressed concrete channels as the conveyor support has been developed. In the unique design on which patents are pending, the U-shaped beams are inverted so as to also serve as a protective cover for the belt, drive, idlers and the material being handled.

Lower initial cost is cited as the chief advantage of the prestressed construction. Inserts for idler attachment are integrally cast in the channels, eliminating the need for steel hangers. Supporting piers and changeovers may be pre-cast or cast-in-place and no steel structurals are required. Comparative studies for the first installation, a 1½-mi conveyor at a large Western industrial plant, indicated savings of 40% over conventional steel construction.

Maintenance costs are also lowered, due to the concrete's inherent freedom from weathering and to the ease of servicing made possible by inspection ports at each idler. Permanence in any environment may be expected from the design, the use of concrete being especially advantageous near the sea and in other corrosive atmospheres. **The Frank J. Madison Co., CE-8, 607 Market St., San Francisco 5, Calif.**

Packaged Control Unit

COMBINING THE FAMILIAR BUBBLE tube method of measuring level and the reliability of Rotax electrical control, the company is now offering a "packaged" control unit for use in industrial processing and in water and sewage treatment plants.

Features of the instrument are: ±0.5% accuracy; ranges from 0-10 in. of water up to 0-10 ft of water; no cleaning or servicing problems; and simple to install, even in inaccessible locations such as reservoirs and underground tanks.

(Continued on page 155)

WALKER PROCESS SPARJAIR COMPLETE SEWAGE TREATMENT PLANTS

Designs for all Developments and Land Planning Projects

Hampton Pk. (Hsg. Devel.), Ill.—1 mgd tot. cap.

TRAILER PARKS

Finn Trailer Ct., Ill. (365 units)—45,500 gpd.

SHOPPING CENTERS

Hillcrest Shpg. Ctr., Joliet, Ill.—50,000 gpd.

Sparjair units overcome previous objections to locating a plant near residences, shopping areas, schools, etc. Its new but proven principle of Contact Stabilization aerates and thoroughly oxidizes all odor producing wastes.

Nested design provides complete treatment equal to large municipal plants.

1. Permits development of outlying, low cost land.
2. Capacities from 50 to 5000 population equivalent.
3. Eliminates septic tanks and drain fields.
4. Virtually automatic—Simple operation.
5. Approved by Health Authorities.
6. Odor free — no septic or stale operations.

Details and layouts are available to Consulting Engineers and their Architects, concerned with the design of package sewage and water treatment plants. Write factory at P. O. Box 266, Aurora, Ill. for complete information.

Walker Process also offers CLARIPURE Package Water Purification Plants—pre-designed capacities from 50 to 600 gpm.

WALKER PROCESS EQUIPMENT INC. FACTORY • ENGINEERING OFFICES LABORATORIES AURORA, ILLINOIS

EQUIPMENT MATERIALS and METHODS

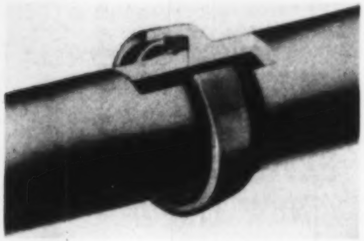
(continued)

The new controller consists of a compressor, a purge rotameter, diaphragm pressure element, damping restrictor, Rotax contacts, plug-in relays and a pump sequencing relay. It can be furnished as an indicator, a recorder, or, where long distance transmission is required, as a telemeter transmitter. All components are housed in a single instrument case, to which a bubble tube is connected. **The Foxboro Co., CE-8, Foxboro, Mass.**

Wedge-Lock Clay Pipe

THE DEVELOPMENT AND INTRODUCTION of Wedge-Lock Claypipe—the new snap-together plastisol joint—has added a new concept to factory-made joints. With Wedge-Lock, conventional jointing procedures are eliminated; and the source of contamination is wiped out, simply and effectively.

Initial explorations indicated the need for a factory prefabricated joint that would meet the following qualifications: resistance to both chemical and bacterial corrosive agents, deterioration and dimensional change while in storage and in shipment, and to roots; properties to combat infiltration and exfiltration; flexible enough to withstand vibration and trench settlement after installation; and reasonably simple and inexpensive to manufacture and fabricate.



Double-Ball Principle Design

A new joint to meet these qualifications was developed and patented by the company as Wedge-Lock. Cast on the spigot end of Wedge-Lock Clay Pipe is a solid, smoothly curved ring of plastisol. A mating ring of the same tough, flexible material is cast inside the bell. Wedge-Lock is designed on the double ball principle, which permits easy and rapid installation. When the joint is made it reaches and holds maximum compression, resulting in a tight line, which prevents infiltration, exfiltration and penetration of roots. **Robinson Clay Products Co., CE-8, P.O. Box 1070-R, 65 W. State St., Akron, Ohio.**

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LARGE FASTENERS

HEX, SQUARE AND SOCKET HEAD BOLTS
HEX, JAM AND SQUARE NUTS
THREADED AND LOOP RODS
RECESSED PIN NUTS AND PINS
HEX AND SOCKET HEAD CAP NUTS
COUPLING AND SLEEVE NUTS
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Size: 1³/₄" thru 12" bolt diameter

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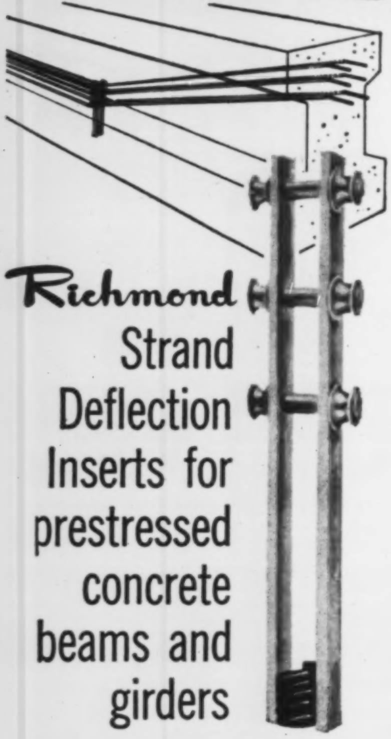

Pretensioning

Richmond
Strand
Deflection
Inserts for
prestressed
concrete
beams and
girders

Included in Richmond's complete line of inserts and accessories for prestressed concrete are a variety of strand deflecting devices, designed to accommodate ¾", 1" and 1¼" bolts or eye bolts to suit your project and match your pretensioning bench.

Richmond Strand Deflectors are manufactured for single, double and triple lines of strands and are available with or without keepers or rollers.

There is a standard line of Richmond Strand Deflection Inserts but, since requirements for deflecting devices vary widely, special units can be manufactured on request to suit individual needs.

For information about Richmond-engineered Strand Deflection Inserts for prestressed beams and girders contact us or our distributors: Intercontinental Equipment Co., Inc., 120 Broadway, New York 5, N. Y....and if you have a specific concreting problem, ask our Technical Department about it—they can help you. Write to:—

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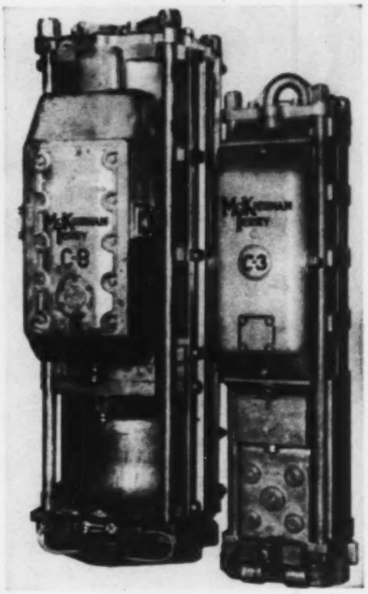
EQUIPMENT MATERIALS and METHODS

(continued)

Double-Acting Pile Hammers

The company has added versatility to its line of C-Type double-acting pile hammers with the introduction of two new models, designated as C-3 and C-8, which expands the line to meet a broader range of pile-driving requirements.

The new models follow the design of the basic C-5 hammer and its all-new patented operating cycle which allows a high rate of energy output at low steam or air consumption. The line features self-seating valves that eliminate need for additional air or steam as the hammer ages, and high-speed operation combined with low striking velocity comparable to that of single-acting hammers.



Self-Seating Valves

C-Type hammers come furnished with the differential pressure lubricator essential in the company's recently announced Dualtube Lubrication System. The 8,500-lb C-3, delivering 130-140 blows per minute in averaging driving, works with either a 500 or 600-ft air compressor, or a McKiernan-Clayton steam generator (WOM 110) utilizing 1,350 lb of steam per minute. Because of its unique operating cycle the C-3 can produce as much as double the work of other hammer types on a given volume of steam or air. Its work scope covers wood piles, most gauges of steel sheeting, and other piles of up to 60-ton bearing. **McKiernan-Terry Corp., CE-8, Dover, N. J.**

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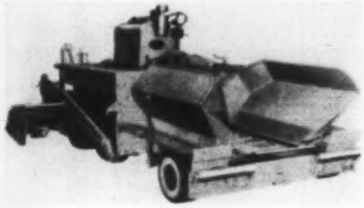
EQUIPMENT MATERIALS and METHODS

(continued)

Bituminous Paver Finishers

Finger-tip controlled folding hoppers and steering control improvements are just a few of the many new features of the company's redesigned Express and Suburban bituminous paver finishers.

Hopper wings are hinged at the conveyor line so that all material moves onto the conveyor when sides are raised, assuring maximum use of each load of bituminous mix and reduced hand labor. Both hoppers are hydraulically operated through simplified controls that are standard equipment and permit operator adjustment of "wings" for travel width clearance or for paving around obstructions.



Express Paver

This new folding feature also reduces "dead" hopper areas and hand shoveling. Designed to reduce truck waiting time and permit additional operation between truck loads, the hoppers' folding feature provides for a free and steady flow of bituminous material to the conveyor and spreading screws.

Capacity of the Express Paver hopper remains at 10 tons, and the Suburban Paver hopper at 4 tons—larger than any other small machine. The pint-sized paver includes a front wheel support to absorb shock of dumped loads without disturbing mat and screed level. **Blaw-Knox Co., Construction Equipment Div., CE-8, Mattoon, Ill.**

Improved Drawing Compass

Known as the PIAB compass, the instrument is recommended for technical draftsmen, engineers, and architects. It can be used as a bow compass, dividing compass, rod compass, perforating compass, and cutting compass. It is made of selected pressed castings, chrome plated and deoxidized to prevent corrosion. It may be equipped with cutting blades, inking pens, or lead holding devices, making the instrument suitable for many types of drawing requirements. **Carl H. P. Pepjung, CE-8, Am Wall 175-177, Postfach 1328, Bremen 1, Germany.**

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. . . form round concrete columns faster, easier, and for less cost

Because they are low in cost, save labor, and speed projects to completion, Sonotube Fibre Forms offer the fastest, most economical forming method for round columns of concrete.

Highly adaptable on the job, Sonotube Fibre Forms can be sawed for tie-in with walls and beams, punched for anchor bolts or dowel rods, and cut for utility outlets. And, because these forms provide a self-cure for concrete, columns formed with Sonotube Fibre Forms require no curing compounds or expensive curing treatments.

Used wherever there are round concrete columns to be formed, lightweight Sonoco Sonotube Fibre Forms place and brace easier, pour and strip quicker, and save both time and labor while cutting overall construction costs.

There's a type to meet any job requirement . . . in sizes 2" to 48" I.D. Order in specified lengths or standard 18' shipping lengths.

Job illustrated: St. Louis Avenue Underpass, Mark Twain Expressway, St. Louis, Mo., Contractor: Fred Weber Contractor, Inc., Designer: Missouri State Highway Department, Rex M. Whitton, Chief Highway Engineer; J. A. Williams, Bridge Engineer, Consulting Engineers: Sverdrup & Parcel Engineering Co.

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for Rubber Waterstop

To splice Gates new Kwik-Seal Rubber Waterstop, all you need is a small splicing kit and simple clamping device. This eliminates the need for a field vulcanizer, molded parts, a power supply or heat.

The Gates Kwik-Seal splice is chemically bonded. The strength of the bond often exceeds the strength even of the rubber—far stronger than government requirements. *One man makes this strong, permanent splice in just 6 minutes—5 times faster than with former methods!*

As a result, this new Gates splicing method cuts your labor costs and speeds the job.

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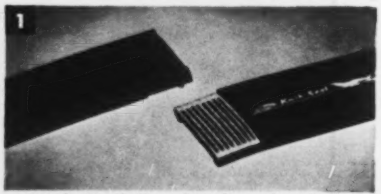
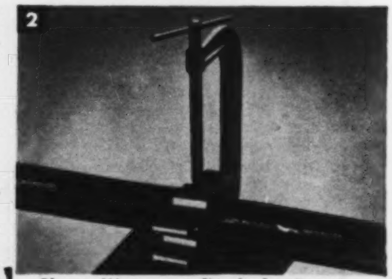


Apply Kwik-Kem bonding chemical to prepared surface.



Clamp Waterstop firmly for 5 to 6 minutes... and it's spliced.

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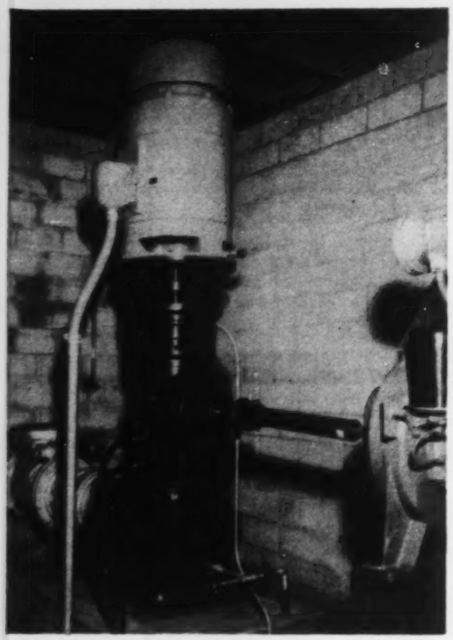
Gates *Kwik-Seal* Waterstop



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Redi-Torq combination right angle gear drive with automatic clutch, eliminates manual switch-over to engine drive in case of power failure. Drive couples to engine by flexible shafting or couplings—engine clutch unnecessary. Engine may be tested without interfering with electric motor operation of pump.

For round-the-clock protection against power failure in water, sewage and fire installations. Developed and proven in municipal and industrial use over several years.

Sizes: 15 to 200 hp; hollow or solid shafts. Write for engineering catalogs.

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13-R

Prefabricated, Reinforced Stair

A NEW CONCEPT IN stair construction that features forms, plus rigid reinforcing sturdily welded into one piece has been developed.

Stairbuilders drafting department first prepares shop drawings of the unit following the architectural specifications. They are thoroughly checked by company engineers and then forwarded to the architect or contractor for final approval. Upon return, they are corrected when necessary and then become the foundation of an integrated production schedule.

In beginning a unit's production, one machine forms the risers to the exact size while another automatically shapes the riser brackets to the correct angle. An adjustable jig holds the brackets and risers in exact position for welding. These brackets, with risers secured in position, are then welded to the reinforcing steel that goes into each unit.

Completely Welded Unit

Next, stringers are accurately positioned and clamped to the template on the assembly table. The risers and brackets are set within the stringers and welded to the temperature rods. Reinforcing steel is then positioned and welded to the temperature rods and brackets. Proper spacing and rigid welding of the reinforcing steel adds immeasurably to the unit's structural strength. This also provides an excellent mechanical bond for the plastic concrete.

The completely welded stair unit is then withdrawn on a dolly to the painting department where areas to be exposed after installation are painted with a rust inhibitive prime coat of paint. When the paint is dry, 2 in. x 12 in. batten boards are steel strapped to the stair sides for protection against possible damage in shipment and, conditions permitting, to also act as side forms in the installation procedure. **Stairbuilders, CE-8, Route 66, McCook, Ill.**

Literature Available

Oriseal Valve—Literature has been published on the Oriseal Valve, which maintains the advantages of a plug type valve, yet is easy to operate, does not require lubrication or periodic maintenance and needs no mechanical means of seating. The Oriseal is a sturdy quarter turn valve. The position of the tee head readily indicates whether the valve is open or closed. Even though the valve is hidden or otherwise inaccessible, the open or closed position is always easily determined. Also available are catalogs on "Four Point" Valves and the Double Pressure Chamber Tapping Machine. **Mueller Co., CE-8, 512 West Cerro Gordo St., Decatur, Ill.**

Table Feeder—A new 4-page bulletin covers data on the Omega Table Feeder. Features, advantages, description and operation, feed range and capacities, accessories and dimensions are all covered in detail for this feeder, Model 0050-04. **B-I-F Industries, CE-8, P.O. Box 1342, Providence 1, R. I.**

Construction Machinery—Brochures are available on Tandem Rollers with torque converter and two-speed transmission (Bulletin HWT-525), 3-Wheel Rollers with torque converter and two-speed transmission (Bulletin HWR-531). Motor Graders 8-D, 9-D, 10-D and 11-D Series and All-Purpose Maintainer Model 25-M (Bulletin HWM-512). All the pamphlets are profusely illustrated. **Huber-Warco Co., CE-8, Marion, Ohio.**

Cam-Lock Forming System—An 8-page booklet shows step-by-step application of the newly-patented concrete forming system. "How-to-do-it" information also covers five new products utilized with the system: two types of heavy duty Break-Back Ties, a Cam-Lock Tie Bracket, a Stiff-Back Cam, and a Scaffold Bracket. **Gates & Sons, Inc., CE-8, 80 South Galapago, Denver 23, Colo.**

Electric Concrete Vibrator—Information is available on the Electric Concrete Vibrator. Lightweight, operated by one man, the EV-26 has thermal overload protection, and is conveniently controlled by manual switch right in the operator's hand. It speeds the work of placing and vibrating concrete in all medium duty applications. **Remington Arms Co., Inc., CE-8, Bridgeport 2, Conn.**

Sewer & Culvert Pipe—The company's 1960 catalog on concrete sewer and culvert pipe is now available. This elaborate, 68-page publication is completely new and contains 9 sections of the latest engineering information on machine-made roller, suspension, cast, special, reinforced concrete pressure, and reinforced concrete subaqueous pipe. **Lock Joint Pipe Co., CE-8, P.O. Box 269, East Orange, N. J.**

Gate Valves—Class A and B Gate Valves for low pressure service are discussed in 4-page Circular No. 16. Photographs and dimensions are contained in this pamphlet. Also offered is information on the Cutting-in Sleeve and Cutting-in Valve for Cast Iron Pipe. Photographs, sizes and dimensions and installation suggestions are included. **M & H Valve and Fittings Co., CE-8, Anniston, Ala.**

Tractors and Construction Equipment—Thirty-three action photos in a new 4-color 16-page booklet show loaders, backhoes, dozers, eartheavators, fork lifts, cranes and other industrial equipment in use with Ford tractors. The applications described include heavy and light excavating; heavy and light loading; scraping; leveling and grading; and lifting, towing and general utility. **Ford Motor Co., Tractor and Implement Div., CE-8, 2500 East Maple Rd., Birmingham, Mich.**

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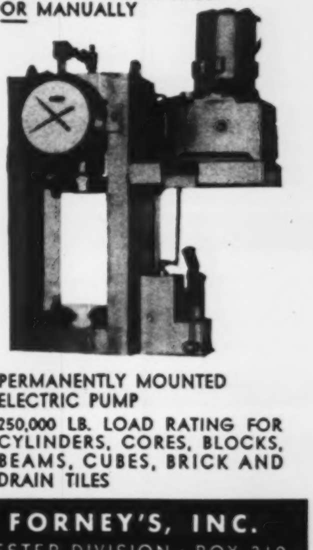

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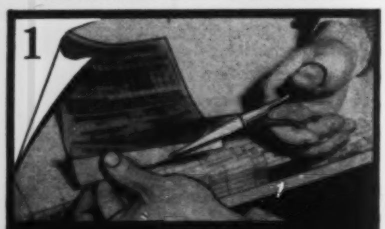

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Films Available

"The Master Builders"—A dramatic color film entitled "The Master Builders," which depicts the construction of a large industrial plant is now available for distribution to manufacturing companies and engineering groups. The 16-mm, 27-min, sound film covers the construction, from ground breaking to mechanical installation and completion, of a vast aluminum producing plant in Ohio and a chemical refinery (Alumina) plant in Louisiana. **F. H. McGraw & Co., CE-8, 51 East 42nd St., New York, N. Y.**

"A Prime Move Forward"—A new 20-min, full-color movie featuring the recently announced OC-9 and OC-96 crawler tractors has been produced. Entitled "A Prime Move Forward," the 16 mm film reports on the engineering design features of these tractors and explains the simplified operation achieved with Trans-Matic transmission. **The Oliver Corp., CE-8, 400 W. Madison St., Chicago 6, Ill.**

"Fury of the Winds"—The powerful Atlantic hurricane is the villain of a new 25-min sound-color motion picture on wind-resistant construction. Entitled "Fury of the Winds," it shows how, through proper design, construction and the use of steel, structures can be built to withstand the gale-force winds, flooding rains, and pounding surf that accompany hurricanes. **Bethlehem Steel Co., Publications Dept., CE-8, Bethlehem, Pa.**

"Dollars and Sense"—A new sound and color slide film illustrating applications and advantages of pneumatic-tire fork trucks of 15,000 to 40,000 lb capacity has been produced. Entitled "Dollars and Sense", the slide film shows how Clarklift fork trucks can move heavy loads over rough terrain, soft ground, or ice and snow encountered in outdoor applications. User benefits such as efficiency, low operating costs, ease of servicing and reduced driver fatigue are shown. **Clark Equipment Co., Slide Film Dept., Industrial Truck Div., CE-8, Battle Creek, Mich.**

Prestressed Concrete—A new color and sound film explaining the principles and uses of prestressed concrete has been made available. Narrated by Professor T. Y. Lin of the University of California, who is recognized as one of the world's foremost authorities on the subject, the movie takes the viewer to construction jobs where prestressed concrete units are being installed, as well as into representative plants where huge concrete beams are formed on factory-like assembly lines. **Calaveras Cement Co., CE-8, 315 Montgomery St., San Francisco 4, Calif.**

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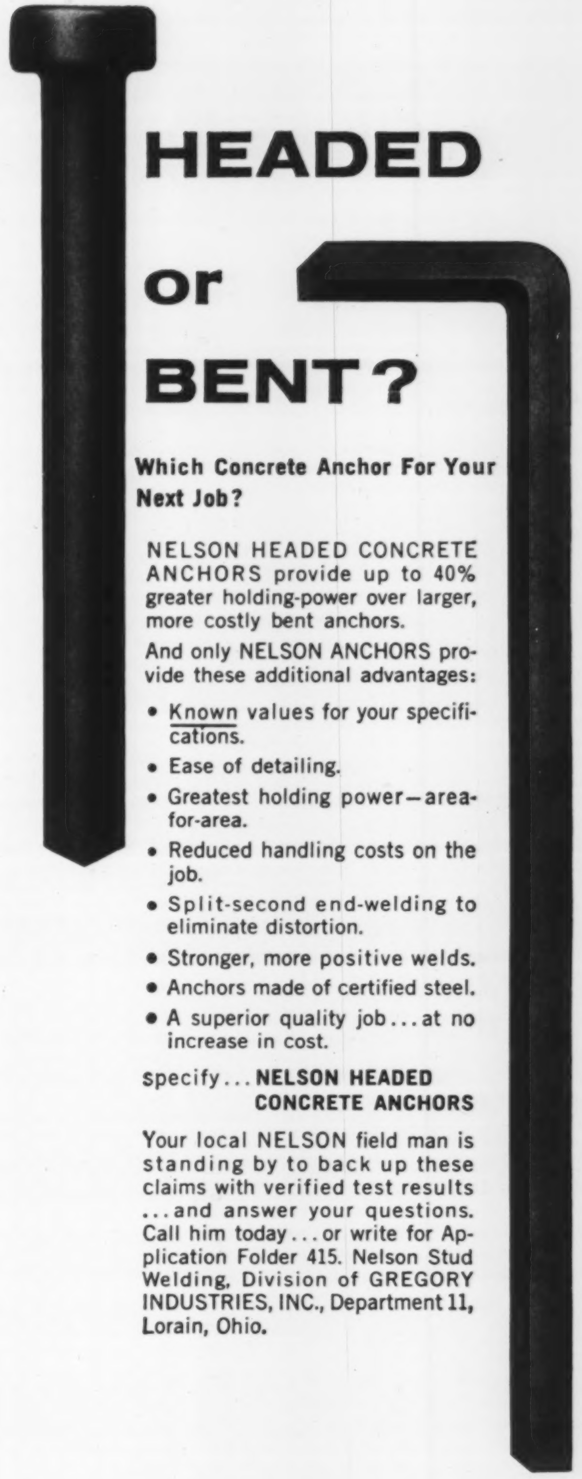
From the MANUFACTURERS

RESEARCH PARK OPEN: A research park established under a specially created SRD (science, research, development) zoning classification was opened. Palos Verdes Research Park, near Los Angeles, Calif., was created to help corporations hold key creative technical personnel by providing them with a stimulating environment in ideal living surroundings, and carry out basic and applied research and development activities under productive conditions . . . **RELOCATING:** Plans for relocating the main office of Rex-Spanall, Inc. from New York City to Milwaukee were announced. The company is a subsidiary of Chain Belt Co., Milwaukee, and was organized last year to market Rex Spanall horizontal shoring equipment in the United States . . . **DEFENSE CONTRACT AWARDED:** With the completion of negotiations to supply 12 structural steel cribs for the Atlas Missile underground launching pads, Continental-Emsco Co., Dallas, Texas, climbed into a solid position as a sub-contractor for the defense industry . . . **MERGER:** Van Norman Industries, Inc., has announced that required formalities have been completed effecting the merger of The American Pulley Co., including its Hubbard Spool Div., into Van Norman Industries . . . **PURCHASE ANNOUNCED:** Bay State Abrasive Products Co., Westboro, Mass., has purchased the Felker Manufacturing Co., Torrance, Calif., it has been announced . . . **AFFILIATION:** E. W. Bacharach, Inc., a leading Kansas City, Mo. firm in the water conditioning equipment field since 1922, has become an affiliate of J. F. Pritchard & Co. . . . **DISTRICT OFFICE OPENED:** Leschen Wire Rope Div., H. K. Porter Co., Inc. has opened a district office and warehouse in Oklahoma City, Oklahoma, for improved service to customers and distributors . . . **ACQUIRES RIGHTS:** Curtiss-Wright Corp. has announced the acquisition of exclusive world-wide manufacturing and sales rights for the Swench manually operated impact wrench from Swenson Engineering, Branford, Conn. . . . **BROADENING PRODUCTION AND DISTRIBUTION:** Yuba Consolidated Industries, Inc., will soon begin manufacturing its Southwest line of compaction equipment at Yuba plants in Bedford, Indiana, and Houston, Texas . . . **COMPANY FORMATION:** Formation of the Bauer Equipment & Supply Co., 139 North Clark St., Chicago 2, Ill., was announced. The new organization will be active in the field of sales and engineering of abrasion resistant castings of manganese steel, alloy steels and Ni-Hard iron . . . **DORR-OLIVER RECEIVES PATENT:** The United States Patent Office has issued a patent to Charles H. Scott of South Norwalk, Conn., assigned to Dorr-Oliver Inc., Stamford, Conn., covering the design of a hydraulically balanced drive mechanism for large and heavy structures which are rotated around a vertical axis . . . **DISTRIBUTOR APPOINTED:** Metal Goods Corp. and Geigher Pipe & Supply Co., both of St. Louis, Mo., have been appointed authorized stock distributors for Hills-McCanna ball valves and diaphragm valves . . . **ISSUED LICENSE:** The first license to produce castings of U.S. Steel Corp's patented "T-1" constructional alloy steel has been issued. Under an agreement, Alloy Steel & Metals Co., is authorized to produce "T-1" steel castings in a wide range of products for a score or so of industries it serves throughout its primary market in 11 western states . . . **NEW NAME:** Bausch & Lomb Optical Co., Rochester, N. Y., will be now known as Bausch & Lomb Incorporated. The new name, which was recently approved by company stockholders, recognizes the fact that B&L is not restricting its research and manufacturing interests to the field of optics alone . . . **PURCHASES DIVISION:** The purchase of the Forms Division of Waco Manufacturing Company, a subsidiary of Waco-Porter Corporation, by Simplex Forms System, Inc., of Rockford, Ill., has been announced. The acquisition includes inventory and manufacturing equipment for the Waco line of heavy industrial and commercial forms for concrete construction. Several key personnel of the Waco Forms Division will join the Simplex organization . . . **APPOINTMENTS:** David M. Burke has been named sales representative for the Master Builders Company's Pittsburgh branch office.



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July

Journals: Hydraulics, Sanitary Engineering, Structural, Surveying and Mapping.

2541. Limit Design of Reinforced Concrete Beams, by D. T. Wright and C. Berwanger. (ST) This paper presents complete analyses of the inelastic behavior of a two-span continuous reinforced concrete beam, for both simple plastic and strain-hardening, moment-rotation relationships. The analyses predict rotation requirements that may be compared with limiting rotation capacities in design.

2542. Secondary Stresses in Parallel Wire Suspension Cables, by Thomas Alan Wyatt. (ST) The working stress in a parallel wire cable is normally based on the average stress across a section of the cable. This paper analyzes the variation of stress across the section, caused by deflection of the cable. Numerical examples show that secondary stresses may be an important part of the effects of live loading.

2543. Accident Preparedness in Reactor Waste Treatment, by E. D. Harward. (SA) Several technical approaches useful in developing emergency procedures in case of an accidental release of liquid radioactive waste from a nuclear reactor are suggested. Some of the difficulties encountered are presented.

2544. Various Instability Modes of the Fixed Base Column, by D. A. Sawyer. (ST) Equations are developed and comparisons made for the buckling loads of columns fixed at the base and loaded at the upper end by frictionless rollers, and by links of various construction. Discussion of the use of certain of these equations in the field of lift-slab construction is made.

2545. Dynamic Response of Elasto-Plastic Frames, by Joseph Penzien. (ST) This paper presents the results of an analytical investigation involving a single mass system that has an idealized elasto-plastic resistance deformation relationship and that is subjected to the ground motion measured by the United States Coast and Geodetic Survey during the May 1940 El Centro earthquake. All results are presented in the form of graphs.

2546. Drag Forces in Velocity Gradient Flow, by Frank D. Masch and Walter L. Moore. (HY) An exploratory investigation was made of the drag coefficient for a circular cylinder as influenced by a velocity gradient along its axis. Some of the three-dimensional aspects of the flow mechanics were described qualitatively. Experiments indicated that the local drag coefficient varied significantly along the length of the cylinder.

2547. Matrix Analysis of Plane Rigid Frames, by Fernando Venancio Filho. (ST) The problem of plane rigid frames is formulated in matrix form, using the principle of virtual work with displacements or forces as unknowns. The method is especially suitable for highspeed digital computers.

2548. Highway and Bridge Surveys: Analytic Geometry in Highway Design and Layout, Progress Report of the Committee on Engineering Surveys of the Surveying and Mapping Division. (SU) This paper explains methods of using line equations in the computations for highway design and layout based on plane coordinates, and demonstrates self-checking computations. Only basic mathematics are involved. It is believed that the use of the methods as demonstrated will avoid errors and save engineering time in design and layout.

2549. Man Versus Environment, Twenty-Seventh Research Report of the Committee on Sanitary Engineering Research of the Sanitary Engineering Division. (SA) Man's relation to his environment is changing rapidly, especially in terms of the complex problems of environmental engineering resulting from new developments in science and technology. The conference reported here was designed to focus attention on the status of these problems in the major fields of water supply, water pollution, air pollution, food technology, and occupational health.

2550. Surveys at Cougar Reservoir, by Charles N. Oros. (SU) An outline is given of surveys made in the Willamette Valley preliminary to the special surveys at Cougar Reservoir and Dam Site. Factors which must be considered in large scale

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photogrammetric mapping of precipitous high relief areas are presented.

2551. Unsteady Flow of Ground Water into a Surface Reservoir, by William Haushild and Gordon Kruse. (HY) Prediction of the water table position and the amount of water discharged where ground water is flowing from an aquifer to a surface reservoir has not been exact. The nonlinear partial differential equation that describes the shape of the water table is difficult to solve. Approximate solutions obtained by two different methods of the nonlinear equation are presented.

2552. Method for Analysis of Multibeam Bridges, by John E. Duberg, Narbey Khachaturian, and Raul T. Fradinger. (ST) A general method for the analysis of multibeam bridges is presented. Expressions for moment, shear, and torque in each beam element due to a concentrated load acting at any point on the multibeam bridge are derived. The method developed is applied in calculating the vertical moments in beam elements of a solid square section constituting a multibeam bridge.

2553. SDR Survey for Proposed Chesapeake Bay Crossing, by Walter C. Beckmann, Charles L. Drake, and George H. Sutton. (SU) The application of a wide band, spark source echo sounder, the Sub-Bottom Depth Recorder (SDR), to foundation studies for the proposed Chesapeake Bay Highway Crossing from Little Creek to Cape Charles, Va., is described in detail. Reflection horizons are correlated with varying properties of the sediments as revealed in test borings.

2554. Automatic System for Monitoring Water Quality, Twenty-Eighth Progress Report of the Committee on Sanitary Engineering Research of the Sanitary Engineering Division. (SA) Personnel of the Lehigh Water Resources Research Council, under contract to the Interstate Commission on the Delaware River Basin, have developed a fully automatic sampling facility for parameters which are indicative of water quality.

2555. Basic Column Strength, by Lynn S. Beedle and Lambert Tall. (ST) A summary is presented of a theoretical and experimental investigation of the strength of centrally loaded columns as influenced by residual stresses and variations in the yield-stress level. It is shown that the basic strength of structural steel columns containing residual stresses may be expressed in terms of the tangent modulus. Approximations suitable for design use are suggested.

2556. Solubility of Atmospheric Oxygen in Water, Twenty-Ninth Progress Report of the Committee on Sanitary Engineering Research of the Sanitary Engineering Division. (SA) For many years, the saturation concentrations of gaseous oxygen dissolved in distilled water have been accepted as correct. Recently a group of researchers in England conducted experiments that showed significant differences from the previously accepted saturation concentrations. The research conducted herein was to determine true saturation values throughout the normal range of natural stream water temperatures.

2557. Sedimentation in Reservoirs in the Southeast, by John E. Jenkins, Charles E. Moak, and Daniel A. Okun. (SA) The most recent reservoir sediment data have been analyzed in this report to evaluate factors that can be used to predict sedimentation in reservoirs in the southeastern United States.

2558. Light Conversion Efficiency of Algae Grown in Sewage, by William J. Oswald. (SA) Engineering design of cultures of algae for effective waste treatment or reclamation is dependent on the algal light conversion efficiency, which is highly variable and strongly influenced by the environment. This paper presents results of studies of light conversion by sewage-grown algae as a function of physiochemical environment.

2559. Lateral Buckling of Beams, by J. W. Clark and H. N. Hill. (ST) This paper is intended to provide a brief summary of information that may be used as background material in writing specifications for the design of beams and girders whose strength is controlled by lateral buckling. Various design formulas that have been proposed for beams are compared with each other and with experimental and theoretical beam strengths.

2560. Discussion of Proceedings Paper 2166, 2365, 2379. (SU) Michael V. Smirnoff, William M. Spann, Albert A. Stanley, and Robert C. Sheldon on 2166. T. F. Hickerson on 2365. Francis Bates on 2379.

2561. Discussion of Proceedings Paper 2343, 2407, 2554. (SA) Harris F. Seidel on 2343. K. J. Ives on 2407. C. H. J. Hull on 2554.

2562. Discussion of Proceedings Paper 2260, 2311, 2335, 2339, 2340, 2429. (HY) R. J. Garde and John L. Bogardi on 2260. Charles G. Gunnerson on 2311. Murray Blanchard, Arthur H. Frazier, and J. C. Stevens on 2335. Paul C. Constant, Jr., Marcel Bitoun, Claud C. Lomax, Joseph W. Maier and Thomas C. Miller, and J. M. Robertson on 2339. Gerald Lacey and N. Rajaratnam on 2340. Henry J. Tebow on 2429.

2563. Discussion of Proceedings Paper 1708, 2346, 2350, 2384, 2450. (ST) Robert H. Sherlock on 1708. A. A. Eremin on 2346 and 2350. Lester H. Gabriel on 2384. Richard H. J. Pian on 2450.

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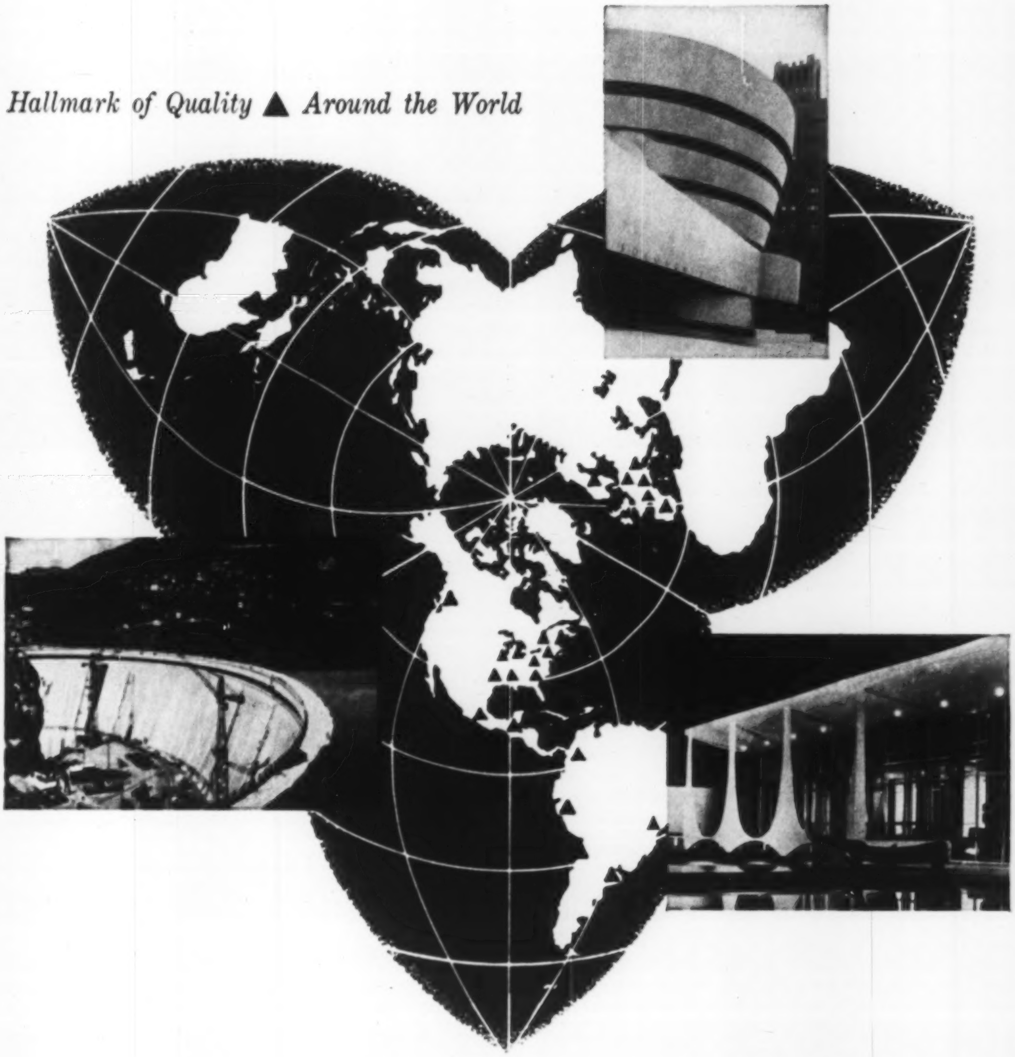

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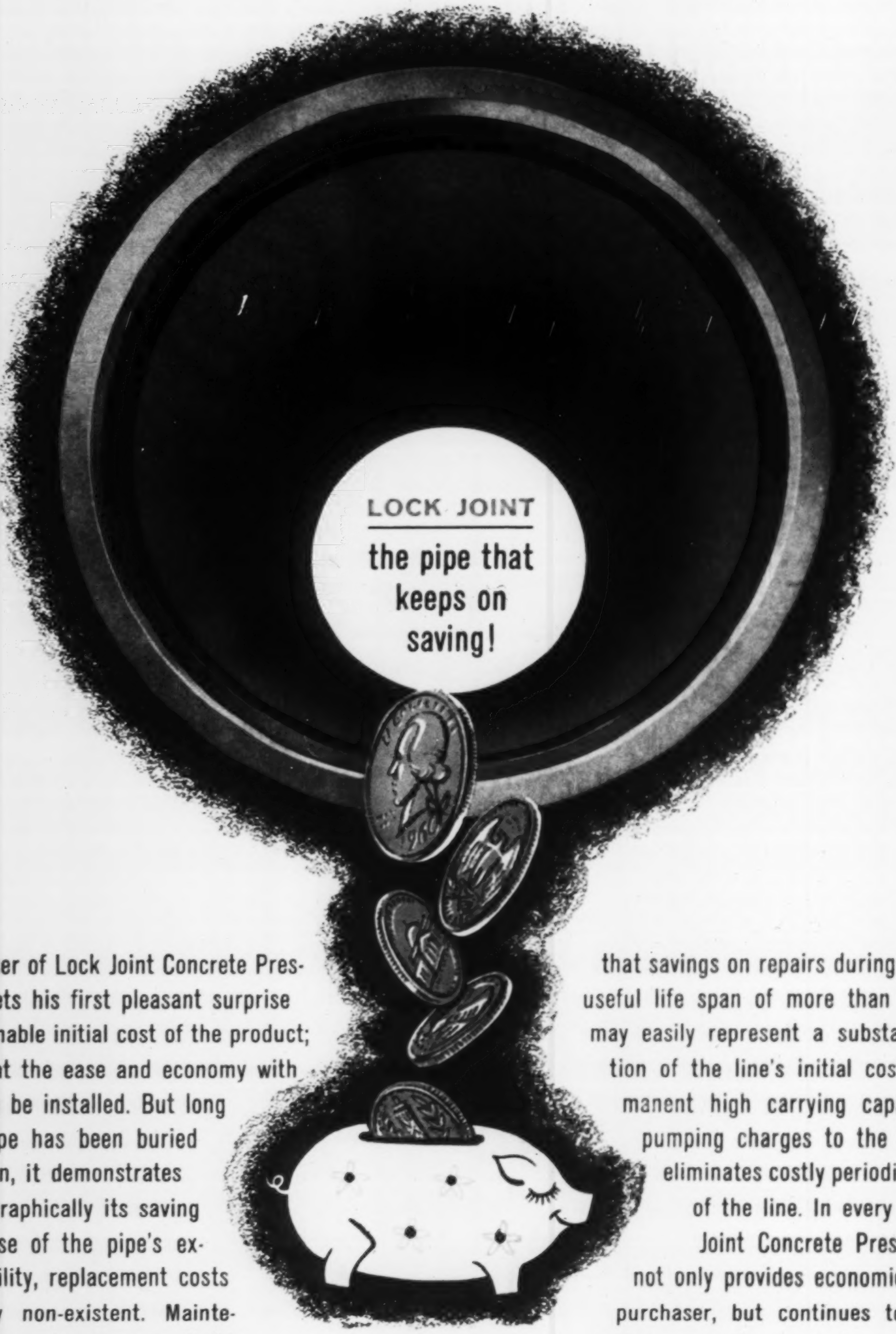
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